NATIONAL FUEL RESERVES AND FUEL POLICY

HEARINGS

BEFORE THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
UNITED STATES SENATE

EIGHTY-SECOND CONGRESS

FIRST SESSION

PURSUANT TO

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(81st Congress)

A RESOLUTION TO INVESTIGATE AVAILABLE FUEL RESERVES AND FORMULATE A NATIONAL FUEL POLICY OF THE UNITED STATES

MARCH 7 AND 8, 1951

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NATIONAL FUEL RESERVES AND FUEL POLICY

WEDNESDAY, MARCH 7, 1951

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The committee met, pursuant to call, at 10:30 a. m., in the caucus room, Senate Office Building, Senator O'Mahoney (chairman) presiding.

Present: Senators Joseph C. O'Mahoney (Wyoming), Clinton P. Anderson (New Mexico), Russell B. Long (Louisiana), Hugh Butler (Nebraska), Guy Cordon (Oregon), and Zales N. Ecton (Montana).

Also present: Max W. Ball, oil and gas consultant, 1025 Vermont Avenue NW., Washington, D. C.; John Battle, president, National Coal Association, Southern Building, Washington, D. C.; Ivan Bloch, consulting engineer, 621 Park Building, Portland, Oreg.; William H. Cooke, chairman, Coal Defense Committee, and president, Little Sister Coal Corp., 310 South Michigan Avenue, Chicago, Ill.; Frank Earnest, president, Anthracite Institute, Wilkes-Barre, Pa.; Eugene Holman, president, Standard Oil Co. (New Jersey), 30 Rockefeller Plaza, New York, N. Y.; J. Ed Warren, president, Independent Petroleum Association of America; A. Jacobsen, chairman, National Oil Policy Committee, API, Amerada Petroleum Corp., 120 Broadway, New York, N. Y.; Paul Kayser, president, Independent Natural Gas Association, and president, El Paso Natural Gas Co., Houston, Tex.; L. F. McCollum, president, Continental Oil Co., Sterling Building, Houston, Tex.; C. J. Potter, president, Rochester & Pittsburgh Coal Co., Indiana, Pa.; Ralph E. Taggart, president, Philadelphia & Reading Coal & Iron Co., Reading Terminal, Philadelphia, Pa.; Dr. Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana), 910 South Michigan Avenue, Chicago, Ill.; and Arthur A. Sandusky, committee staff counsel.

The CHAIRMAN. The committee will please come to order.

Gentlemen of the panel, I want to say that the chairman of the committee and all the members are very grateful to you for your willingness to attend this round-table discussion. The theory of the meeting is that the members of the committee will be afforded an opportunity, if I may say so, to pick the brains of the experts of the various energy industries.

We should like to have you, each in your good time, make your statements briefly as to the problems of energy sources, development and utilization as you see them, and then to question one another. If we could develop here a cross-examination of experts by experts, I think that the Congress and the public as a whole would be very much enlightened.

I need not say to this group that the development and the use of natural energy resources is the basis of both industrial and military development. The United States has become the greatest Nation in the world, first, because we have had a great people here of pioneer instincts who were willing to come to grips with every problem that has arisen throughout the history of the Government and throughout the history of the development of the North American Continent, but, secondly, our great primacy in the world has developed because we have had here in continental United States a wealth of natural resources which has exceeded that to be found in any other area of the world. To be found, to be known, and to be developed, perhaps I should say.

The supremacy of Great Britain as a commercial nation for more than 100 years after the Napoleonic Wars was due in large measure to the same two factors, a great people and a great natural resource, namely coal, but the United States has outstripped Britain as it has outstripped all the rest of the world.

Sometimes I think that the public does not realize to what an extent this development has taken place in America. The Bureau of the Census tells us that in 1949 or 1950 there were about 150,000,000 people plus in the United States. In 1899 the population was less than 76,000,000. In other words, our population has doubled in a half a century, but our energy resources from coal, from oil, from gas, from hydroelectric power has more than quadrupled. In other words, every citizen of the United States living today has twice as much natural energy working for him as the individual had 50 years ago.

From time to time we hear depressing prophecies as to the future. I have never been very much impressed by the prophets of doom, and I am not so impressed now. We know, according to the old estimates, that the United States was the possessor within its continental limits of twice as much coal reserves as all the rest of the world combined. Recent estimates seem to pare that down. These estimates must be examined.

There was a time when with respect to oil we were far ahead of any other area in the world, but now, according to the estimates of the API, Saudi Arabia alone may have twice as much known reserves as continental United States. I do not know.

You get those reports, but in any event we know that there are areas subject to the jurisdiction, the imperium or the dominium, as the words have been used in the Tidelands case recently, of great new possible areas for the development of petroleum. We are told that the United States has about 90 percent of all the natural gas. The possibilities of hydroelectric power, of course, are limited by the stream flow and by the extent of developing hydroelectric power.

It would seem, therefore, at first glance that the people of the United States still have a great wealth of natural energy resources which will continue to make this Nation the leading industrial Nation in the world and the leading military Nation if war has to come again.

We know now that modern war is just a phase of industrial and economic development, but the dangers that we face, if we do face any, with respect to the development of these resources, I think have been epitomized in a memorandum which was issued on the 17th of February by the Munitions Board to the Secretary of the Army, the Secretary of the Navy, and the Secretary of the Air Force. I think it

is worth while to read that into the record at the outset of this hearing:

Subject: Availability of fuels

1. The relative availability of various kinds of fuel will change as mobilization and defense production are stepped up. Shortages of some fuels have already developed in some localities.

2. In order to give the maximum support to the over-all defense effort, and to reduce the possibility of fuel-procurement difficulties, it is necessary that all fuel use be carefully reviewed, particularly for areas of limited fuel resources and for installations of large fuel consumption.

3. Coal is the Nation's largest fuel resource. It is available quite generally, except in west-coast States. It should be employed, as far as practicable, at all military facilities—both command and industrial, as well as military-sponsored industrial facilities. Mine production in general is expected to meet over-all requirements, but in some areas there will be difficulty in obtaining deliveries due to a shortage of coal cars. For this reason consideration should be given to obtaining requirements from the nearest mines even though quality is not up to that desired in normal times. Assurance of fuel supply and adjustments to defense needs should be basic guides in determining the fuel to be used.

4. Natural gas is a favorite fuel because of its convenience, cost, and labor-saving possibilities. Wherever the use of coal is impracticable, gas should be considered, although it will be necessary to make sure that its availability will continue for a reasonable period of time. The popularity of the fuel is expanding its use at such a rate that the demand may outrun the great expansion in pipelines and distribution systems. In case it becomes necessary to regulate the use of gas, it will be well to keep in mind that first preference will probably be given to domestic and small space heating use and second preference to special industrial uses. Other uses will bear the brunt of control regulations.

5. Fuel oil has been abundant the past 2 years, especially in seaboard areas, but under the stepped-up defense program the situation is changing. Petroleum products will be in great demand. There is a shortage in both tank cars and tankers. For this reason the use of heating oil and fuel oil should be kept to the practicable minimum.

6. Liquefied petroleum gases (LPG) have been available in great quantities during the postwar period. Their availability for general use is now being greatly reduced. Butane is required for the synthetic-rubber program and for certain high-octane gasolines. Propane is still available but the shortage of pressure tank cars is delaying deliveries. This condition will grow worse. For these reasons use of LPG should be kept to a minimum except in areas within trucking distance of refineries where supplies are adequate.

7. *Multiple fuel equipment.*—Installations having equipment for burning more than one fuel should arrange to use the fuel most readily available under the present emergency conditions. In general, first preference should be given to the use of coal, second preference to natural gas, and third preference to fuel oil.

8. *Conversion of facilities.*—In some areas the fuel situation will make necessary the consideration of converting fuel-burning equipment. No general rule can be laid down for guidance. A decision should be made on the basis of the foregoing comments and the factors involved in making the conversion, i. e., the amount of fuel involved, the critical materials required for the conversion, and the man-hours of labor. In general, the fuel preference should be: First, coal; second, gas; third, oil. Full weight must be given in all cases to local conditions.

For the chairman:

JERRY V. MATEJKA,
Major General, United States Army,
Military Director for Production Management.

When Senate Resolution 239 was introduced in the last Congress, the national emergency with which we are now confronted did not exist, at least to the knowledge of the Congress and the people. When that resolution was presented the main purpose was to make a study of our fuel reserves and our methods of development, the methods of stimulating use and a study of the effect of foreign imports upon local development and other aspects of a peacetime economy.

There was no thought at that time of anything but the encouragement of what we call free private enterprise.

It is only necessary, however, to read the document that I have just placed into the record to realize that we are now confronted with the aspects, the regulatory and the control aspects of a war economy, all of which we regret, but it affords the opportunity for the widest discussion by the gentlemen who have assembled here in the panel.

Let me insert at the beginning of the testimony the text of the original resolution and the text of the resolution of this Congress which extended to June 30, 1951 the date for a report by this committee.

(S. Res. 239 and S. Res. 33 are as follows:)

[S. Res. 239, 81st Cong., 2d sess.]

RESOLUTION

Resolved, That the Senate Committee on Interior and Insular Affairs, or any duly authorized subcommittee thereof, is authorized and directed (1) to make a full and complete investigation and study of the available fuel reserves of the United States and the present and probable future rates of consumption thereof; (2) to formulate a national fuel policy to meet the needs of the United States in times of peace and war, such policy to include the use of all fuels and energy resources except atomic energy; (3) to study and recommend methods of encouraging developments to assure the availability of fuels adequate for an expanding economy and the security of the United States; and (4) to report to the Senate at the earliest practicable date, not later than January 3, 1951, the results of its investigation and study together with its recommendations.

SEC. 2. For the purposes of this resolution, the committee, or any duly authorized subcommittee thereof, is authorized to employ upon a temporary basis such technical, clerical, and other assistants as it deems advisable, and is authorized, with the consent of the head of the department or agency concerned, to utilize the services, information, facilities, and personnel of any of the departments or agencies of the Government. The expenses of the committee under this resolution, which shall not exceed $20,000, shall be paid from the contingent fund of the Senate upon vouchers approved by the chairman of the committee.

[S. Res. 33, 82d Cong., 1st sess.]

RESOLUTION

Resolved, That the authority of the Committee on Interior and Insular Affairs, or any duly authorized subcommittee thereof, under S. Res. 239, Eighty-first Congress agreed to August 15, 1950, and as further extended by S. Res. 374, agreed to December 21, 1950 (providing for a study and investigation of the fuel reserves and to formulate a fuel policy of the United States), is hereby continued through June 30, 1951.

The CHAIRMAN. I have no particular order to follow here, but Mr. Ball, your name is at the head of the list. You have appeared before congressional committees many times in the past, and you have always been able to add to their information.

Mr. BALL. What do you want me to do, make a speech?

The CHAIRMAN. I would like to have you make a brief opening statement, sir, as to your views on this energy resource problem.

Mr. BALL. I think we have two things to consider. One is the long-term view and one is the short-term view. What are we looking at during this defense period and what are we looking at on down the road for the indefinite future for the Nation?

On the long-term look, frankly I have no apprehensions about our energy resources or any of our other natural resources. I would like to advance a point of view on that—a point of view that seems to me to be perfectly sound. It is always so much easier to look at the

tangible factors and neglect the intangible factors, but the development of any new resource or any natural resource, particularly any energy resource, depends on two things:

One is what is in the ground, which is a tangible factor; the other is the ingenuity and the resourcefulness that finds it and gets it out of the ground and puts it to use.

That resourcefulness is not confined to finding and producing and utilizing the resource. It also extends into the field of replacing it with something better or something more abundant when the time comes. It is so easy to put the emphasis on the physical factor of how much in tons or British thermal units or in some other measurable factor have we of this or that resource, and to forget that the other resource, which is man's resourcefulness, is our greatest natural resource and is unlimited; that we never have yet in human history come to the limit of man's resourcefulness where man was allowed to exercise it under conditions which stimulated its free play.

I can give you a long-term historical example of what I am thinking about. In the early days of the Roman Republic, long before the Empire, the weapons were bronze. Rome's early conquests were made by bronze weapons which meant copper, and as long ago as the days of the Tarquins the Romans were worried because their resources of copper were becoming less. The mines of Cyprus and the mines in Spain were approaching the limits of their high-grade ore, and the Romans worried about it.

I do not know whether there was any discussion about artificial controls and distribution of the utilization of their copper so as to be sure they had an ample supply for the weapons they needed to go on conquering the world, but whether they did or not, two things happened. Those two things are illustrative of what happens in human affairs when human resourcefulness is allowed free play.

One was that as the years went on the technique and technology improved. Human resourcefulness applied to the getting of copper improved so much that today, from those same mines, a pound of copper can be bought in Rome for less, in terms of wheat or any other commodity, than it cost in the days of the Tarquins. The ore comes from deposits which in those days would have been very much more expensive to mine but which, as time went on, through the application of human resourcefulness, became not more expensive but cheaper.

But the other great thing and the more typical thing that happened is that when they began to worry about not having enough copper for their weapons, they did not run out of weapons. There never would have been enough copper for all the weapons for all the wars that have come along since that time. They replaced copper with a better and more abundant material when they began to use iron weapons, and we are still using iron in the form of iron and steel in tremendous amounts.

The moral of the thing, it seems to me, is that if the human mind is allowed to exercise resourcefulness, we do not need to worry too much about the supply of our resources.

Now, applying that to the fuels with which I am most familiar, the fluid fuels, oil and gas, we have for generations, a couple of generations at least, worried about our supplies. I happened to have served on a committee back in 1915, a committee of the United States Geological Survey, which in response to a Senate resolution made a survey of

our available oil resources, and we came up with something like 7,000,000,000 barrels, which we use now in about 3 years. That was all we knew about the resource then.

Today, despite the fact that we have used I do not know how many billion barrels in between that time and this, in those 35 years, we have known discovered reserves of oil of 30,000,000,000 barrels in the United States, and that is not the end of it. We know from what we have experienced that we can keep on discovering new oil in the United States for a considerable period ahead at an ever-increasing rate. That is geological thinking.

As chairman of a subcommittee of the National Petroleum Council, I sat in on a discussion of one of its panels in Tulsa 2 weeks ago. We had there 18 geologists.

I would say that we had 18 of the top-flight geological thinkers in the United States. We had, for example, nine presidents, presidents-elect or past presidents of the American Association of Petroleum Geologists. The group represented the best geological thinking that I think could be assembled in one room. The report of that panel is in preparation. I cannot give you any figures from it, but I can give you what everybody agreed on without any exception, namely, that given the manpower and given the economic and political climate that we have had in the past, the discoveries of oil and gas will not only be large but will increase through a long number of years ahead.

We have more undiscovered oil in the ground and more undiscovered gas in the ground than we have found so far. I think there is no question about that, and we can continue to discover at an increasing rate.

Now, that does not mean that I am among those who say because we have always discovered all the oil we need and all the gas we need, we always will. Obviously, there comes an end to the time when we can continue to discover at an ever-increasing rate.

The law of diminishing returns is going to begin to operate sooner or later, and to say anything else is like saying, "Well, because we always discovered all the oil we need, we always will." As I have said before, it reminds me of the old man who said "Because I have lived to be 98, I will live forever."

We will not indefinitely discover new oil and new gas. We can, however, count on discovery of new oil and new gas at an increasing rate for many years to come. We can also count on another thing, and that is that when we cease to discover new oil and new gas at the rate we need, if human resourcefulness is allowed scope, we will replace well oil and well gas with something more abundant and probably something better.

Now, we know today some places we go to for such replacements. We know that when the need comes we have in our synthetic sources, both coal and oil, tremendous reserve supplies. When we need them we can turn to them. We are pretty well along on the road to using these. We are not too far from the time when the economic balance may shift in their favor.

Senator LONG. Mr. Ball, could I ask you a question along that line. We are conducting some Tideland hearings at the present time, and I wonder if you have made any study of what the possible reserves are on the Continental Shelf off Louisiana, Texas, and the other States of the Nation.

Mr. BALL. I have had no occasion to make any personal study of that. You will notice that is all I have said so far, I have kept away from tangible figures.

Senator LONG. Have you had occasion to discuss it with someone who has made a study of that?

Mr. BALL. Yes. I have heard and participated in discussions.

Senator LONG. Here is a question I had in mind. The figures we have, for example, indicate that within the original boundaries of the State of Texas, which included the soil beneath the Gulf of Mexico 10 miles into the Gulf, there were 2,600,000 acres, and there were more than 16,000,000 acres from that point to the end of the Continental Shelf.

I wonder if you have heard the discussions as to the possible quantity of oil that might be in the area 10 miles off the shore to the edge of the Continental Shelf, which, for example, would be about 16,000,000 acres, about seven or eight times as great as that within the original boundaries of the State.

Mr. BALL. I have not participated in any of those studies of particular areas. A subcommittee of the National Petroleum Council Committee, of which Mr. McCollum is chairman, is doing some studies of that sort right now.

Senator LONG. I just wondered if the geological opinion or consensus seemed to be that as you got farther and farther out on the edge of the Continental Shelf, you would have a greater or lesser prospect of finding oil.

Mr. BALL. I think you can at least say this: That the geology offshore is at least as favorable as it is onshore, and there is some geological reason to think that the average production per unit of area will be greater offshore than onshore.

Senator LONG. There is no reason to think that it would be less as you get farther out toward the edge of the Continental Shelf, then?

Mr. BALL. No. There are reasons that lead you to think it may be somewhat better.

Senator LONG. Of course, the cost is more.

Mr. BALL. Much higher.

Senator LONG. Mr. McCollum, have you had a chance to look into that matter at all?

Mr. MCCOLLUM. Senator, in a general way, yes, but let me amplify what Mr. Ball has said here. I happen to be chairman of the National Petroleum Council Committee designated to study availability of petroleum and petroleum products in the short-range and long-range period, and this specific question is one that is being studied by that committee. The report should be available in about 60 days and will be far more authoritative than anything which I could give you.

I should like to comment, as a practical matter, that I think it is the general view of the petroleum industry that unit for unit, both areally and vertically, there is as much oil offshore as onshore, including the entire area out to where it becomes too deep to drill.

Senator LONG. Of course, most independent oil men, I believe most of the large companies, feel that oil is where you find it. It is there when you find it, and until that time they want to be convinced. They want to see it.

Mr. MCCOLLUM. A lot of finding of oil extends from an idea, too, bringing the idea to fruition.

Mr. JACOBSEN. Mr. Chairman, is it all right to interrupt if any of us have anything we want to say?

The CHAIRMAN. That would be ideal.

Mr. JACOBSEN. I would like to point out one thing which I believe the other oil men here will agree with, and that is that undoubtedly while oil could be found theoretically out to the edge of the Continental Shelf, the element that you referred to, Senator, namely, the cost element, will prevent the same thorough-going exploration when you get out into the deeper water that we have had onshore. Therefore it would be probably misleading if, for instance, you were to say, "Well, we will take a belt going out 20 miles from shore, we will figure out how much oil has been found for a similar belt from the shore inland, and then say we will find as much or more out at sea."

It is undoubtedly there. There is perhaps even more, but it will not be as thoroughly prospected due to the much greater cost.

Senator LONG. Conceivably you could find it if cost were no item, though. If you simply had to have the oil, conceivably there might be just as much farther on out as there might be close to shore.

Mr. JACOBSEN. Probably with some reservation; namely that if you get to the edge of the shelf, say, to a depth of five or six hundred feet of water, then you really run up against a cost element that would be prohibitive under any conditions, even those conditions of an emergency.

Oil from shale and coal would come in long ahead of that fantastically expensive cost of drilling in 500 feet of water.

Senator LONG. In other words, it would almost be like building an office building in the sea before you ever try to drill for oil?

Mr. JACOBSEN. Yes.

The CHAIRMAN. Dr. Potter, you indicated a desire to step in here.

Mr. POTTER. I would like to address a remark to Mr. Ball.

The CHAIRMAN. Let me ask you now to identify yourself for the record, Mr. Potter.

Mr. POTTER. My name is C. J. Potter. I am president of the Rochester & Pittsburgh Coal Co., Indiana, Pa.

A short time ago Mr. Ball testified, appearing before the Special Subcommittee on Petroleum of the Committee on Armed Services in 1947. At that time Mr. Ball took the very opposite view from what he just told you. I quote Mr. Ball:

> As I told you, I am a geologist, and a geologist who has devoted most of his life to wildcatting, so that by training, instinct, and experience I am and have to be an optimist, but I think we have reached the point or close to the point where we can no longer count on continuing to find oil at an ever-increasing rate. Our demand is increasing and is going to continue to increase. It does not seem to me reasonable to think that we can continue indefinitely to keep finding new oil at an ever-increasing rate.
>
> The argument that because we have always found all the oil we need in the United States we always will seems to me a little bit like the man who says "I lived to be 93, and therefore I will live forever."

He agreed also with the testimony of Mr. De Golyer and Mr. Hopkins at the same time that that was not so.

Senator ANDERSON. Do you find that inconsistent with what he said this morning?

Mr. POTTER. Yes, sir, quite incompatible.

Senator ANDERSON. Why?

Mr. POTTER. I will search his statement out of the record and present it to you, sir.

Senator CORDON. Has he not just made the same statement?

Senator ANDERSON. He changed the age limit to 98 in place of 93. Even you will admit that is consistent, will you not?

Mr. POTTER. No, sir.

Senator ANDERSON. The span of life has grown in the last 3 years.

Mr. POTTER. I will find in the record of this morning the statement that he made and show you the exact points. You said you wanted to start an argument. I am just starting one for you, sir.

The CHAIRMAN. Mr. Ball, in a recent speech the Director of the Bureau of Mines, Mr. Boyd, quoted from Mr. Eugene Ayres, as I recall, the research director for the Gulf Research & Development Co. of Pittsburgh, Pa., an oil man, to the effect that by 1967 the production of petroleum in the United States would not be more than a billion barrels a year. Those are the best figures that this committee has been able to obtain.

The production now is running a little bit over 1.7 billion per year. Do you have any comment to make upon Mr. Ayres' statement?

Mr. BALL. I have Mr. Ayres' report here. I have not studied it. I just got it yesterday. I think, dealing with figures on this sort of thing is an extremely difficult matter, but I think if Dr. Ayres says we will be down to a billion barrels in 1967, that he is being unduly pessimistic in the light of the record. I would be inclined to think that we would be producing a great deal more than that in 1967, because I do not think by that time we will have gotten that far into the law of diminishing returns.

The CHAIRMAN. Let me make a comment at this point and ask for a statement of any of the representatives of the oil industry here with respect to it. This comes out of my recollection of the hearings several years ago of the Special Senate Committee on Petroleum.

We were told at that time, and I think it is the fact, that a very much greater portion of the area of the United States has been tested for oil than that of any other area in the world. That is the reason why the United States led the world in the production of oil for so long a period, but now through the energy and technical skills of our own oilmen, other areas in the world are being tested.

Whereas it is becoming more and more expensive to develop these new sources of oil in continental United States, in other areas of the world comparatively low-cost drilling is still being carried on.

The result has been that the United States, which once was the leading producer of petroleum in all the world, is no longr the leading petroleum producer, so my question is, Is there any thought in the mind of anybody in the oil industry that the United States can ever regain the first position as a producer of petroleum?

Mr. WILSON. What do you mean "regain," Senator? Do you have the impression we are not the leading producer today?

The CHAIRMAN. Within the United States.

Mr. WILSON. Within the United States we are still producing more than half of the total world oil, and we are far, far ahead of any other country.

The CHAIRMAN. That is what I wanted to get on the record, but perhaps I should have stated the question in terms of reserves. We were years ago the leading country in terms of known petroleum

reserves. We are not now the leading country of the world in terms of petroleum reserves, are we?

Mr. WILSON. What country, pray, is ahead of us? We are still the leading country.

The CHAIRMAN. How about the Middle East?

Mr. WILSON. The Middle East is a lot of different countries.

The CHAIRMAN. I am taking that as a whole.

Mr. WILSON. You take a tremendous area, you take the Eastern Hemisphere, why, yes, they are ahead of us. The Middle East, including five or six countries, might be approximately equal to ours, but we are far ahead of any other country still, and our production is still more than half of the total world production.

The CHAIRMAN. Mr. Ball has just testified, as I heard him, that the reserves in the continental United States are about 30 billion.

Mr. WILSON. Yes.

The CHAIRMAN. We are told that the known reserves in Saudi Arabia alone are in excess of 50 billion. Now, is that right or wrong?

Mr. WILSON. I will have to ask Mr. Holman about that.

Mr. HOLMAN. Senator, I think in talking about reserves you have to differentiate between proved reserves and potential reserves. We happen to be operating in both countries, and certainly we would not subscribe to any figure such as you have quoted as far as relative proved reserves in each country is concerned.

The CHAIRMAN. What is your judgment as to the proved reserves in Saudi Arabia?

Mr. HOLMAN. I do not have the figure right before me, but the last figures I saw were in the order of somewhere between 7 and 9 billion barrels.

Mr. MCCOLLUM. Senator, for the record, I quote from the magazine, World Oil, a recent issue, giving the figure of 10 billion barrels reserve for Saudi Arabia on January 1, 1951.

The CHAIRMAN. What about Iran and Iraq?

Mr. HOLMAN. Are those figures there?

Mr. MCCOLLUM. Yes. Iran, 13,000,000,000; Iraq, 8,700,000,000.

The CHAIRMAN. Now add those together and you have a total greater than that of the United States.

Mr. MCCOLLUM. The total for the Middle East is about 48 billion.

The CHAIRMAN. There is the question.

Mr. WILSON. That includes Russia, too?

Mr. MCCOLLUM. No. I shall name the countries: Turkey, Saudi Arabia, Qatar, Kuwait, Iraq, Iran, and Bahrein.

The CHAIRMAN. My question should not have been stated in terms of production, but in terms of reserves. The point of the question is this: Can we hope to continue to make discoveries that will allow the United States to remain on a par with these other discoveries that are going on elsewhere, or are we in fact falling behind?

Mr. JACOBSEN. May I answer that?

The CHAIRMAN. Yes, Mr. Jacobsen.

Mr. JACOBSEN. From the point of view of resources, as you put it, and lumping all of those middle eastern countries as one group, I do not think there is any reasonable hope that we will develop in this country underground proven unproduced reserves in excess of those existing in those countries.

However, just as we are now producing much more than they are, I do think that we can for a considerable period ahead—the number of years nobody can tell—continue to find oil at a rate that will enable us to continue to be the largest producer of oil in the world. I would now like to say a word regarding reserves.

Reserves taken by themselves are not the most important thing, neither in an emergency nor in times of peace. It is ability to produce.

For instance, if the United States were at war and if we had reserves of, say, only 20 billions of barrels, which is only two-thirds of what we have now, and if we needed, say 7 million barrels a day and could produce that, we would be better offf with a producing capacity of 7 million barrels a day and relatively smaller reserves than we would if we had 100 billion barrels and could only produce 4 million.

The CHAIRMAN. Of course, in an emergency or for any useful purpose it is only the amount that you produce that you can use.

Mr. JACOBSEN. Exactly; and, therefore, while these figures of the middle eastern reserves are undoubtedly correct—I mean correct as far as any estimate of that kind can be—merely looking upon them as reserves and comparing our reserves to them would give one an unduly unfavorable picture regarding the position of the United States, because I do think that we can continue to maintain our ability to produce.

Let us assume, for the sake of argument, that we could continue to do what we did last year. We found about 50 percent more new oil added to our reserves, 50 percent more than we produced. We found about 3,300,000,000 barrels, and we took out about 2,200,000,000 barrels. If we could continue that indefinitely, then the actual question of the total number of billions of barrels in reserve is really not terribly important. It is the producibility and the continued producibility that gives the country the oil it will need in war as well as in peace.

The CHAIRMAN. What about your answer to Senator Long that the measure of producibility is probably governed by the cost of drilling for the new reserve.

Mr. JACOBSEN. That is a perfectly good point. Now I am not an expert on foreign production, and Mr. Holman and others know much more about that than I, but I do think that they will agree that this very cheap foreign production is gradually becoming less and less cheap.

First of all, there has always been a certain amount of misinformation or misunderstanding of the subject. This very cheap foreign labor that we hear so much of is not really cheap at all in terms of yield.

The CHAIRMAN. Let the labor-union representatives make note of this.

Mr. JACOBSEN. We are talking about the foreign labor, not the American labor, but it is true; they have cheap labor in South America and cheap labor elsewhere. It is true it is cheap in the sense of wages paid per day, but it is not cheap in terms of yield of units of work.

I might say that one reason why those foreign fields have been so cheap is not that it is cheap to drill, because per foot drilled to any given depth it is far more costly than in the United States. The thing that has made it cheap has been the prolific nature of the fields more than anything else.

The CHAIRMAN. Do you mean that the fields in the Middle East are more prolific than the fields in the United States?

Mr. JACOBSEN. The large fields that are being exploited now in the Middle East are exceptionally prolific. We have had in the United States, for instance, a large field like the east Texas field, which could be compared to the Middle East fields.

In fact, it has some advantage over them in cheapness of drilling and so on, but the particular geological conditions under which oil is being produced in those Middle East countries are on the whole very favorable and tend to give you cheap production.

Senator LONG. How deep, for example, are most of the wells that are in Saudi Arabia? Those are rather shallow wells and are very productive wells; are they not?

Mr. JACOBSEN. Five or six thousand feet; is it?

Mr. HOLMAN. Around 6,000 feet.

Senator LONG. What kind of sand do you get?

Mr. HOLMAN. It is largely limestone production, Senator. There is some sand production there, but the major part of Middle East oil comes from limestone.

Senator LONG. Those are good wells; are they not?

Mr. HOLMAN. Yes.

Mr. WILSON. A very striking figure is that the average well in the United States—of course, that includes a lot of small wells—produces 12 barrels a day. The average well in the Middle East produces several thousand barrels a day. I do not recall the exact figure, but it is several thousand barrels a day.

Senator LONG. Of course, the cost of drilling the wells is somewhat comparable. Even if it costs you twice as much to drill a well, if it produces a thousand times as much oil, you would be way ahead of the game.

Mr. HOLMAN. I would like to elaborate on what Mr. Jacobsen said. When you are talking about reserves, or about the using of crude as a raw material for making products, that is just one of the many elements that go into it.

You have to take into consideration facilities for getting it to the consumer; you have to take into consideration the quality of the oil; you have to take a great many other things into consideration in supplying it to the consumer; and I think that, as a whole, it is quite true that there is misconception about the cheapness of Middle East oil or foreign oil in general.

It just so happens that nature placed a great many of these foreign fields and even some of our domestic fields in rather inaccessible places. That is particularly true in the larger foreign fields ,where the facilities that you have to provide in the way of transportation, in the way of taking care of employees, and so on, make the whole thing add up to a point where it is not as cheap as a lot of people think it is.

Senator LONG. Did I correctly understand the statement that wells in the Middle East are producing 12,000 barrels a day?

Mr. WILSON. I said several thousand. I have forgotten the figure. I do not know whether anyone here recalls it.

Senator LONG. Do you know, sir, what the average is?

Mr. HOLMAN. I do not know what the average is. I think it would probably be readily available. They are in the thousands, though. I think the 12,000-barrel is probably the exceptional well. I think four or five thousand barrels would be probably more what would be the average.

Mr. WILSON. I believe the figure is 4,000 barrels per day.

Senator LONG. On page 113 of this previous hearing on House Resolution 141 and House Resolution 447, I see figures indicating that the average production in the Middle East per well is 3,930. I know in this country if a man gets a 100-barrel well he thinks he is a very lucky fellow.

Now, what could possibly be the offsetting features to make a man think he was not a very fortunate person to have a 3,900-barrel well in the Middle East?

Mr. JACOBSEN. He would still be very fortunate, Senator; but there is one other important element of cost, an increase in cost that has not been referred to yet, and that is the exaction of those various foreign governments. We have seen it in practically every foreign country.

Take Iran. The original concessionaires who went into Iran some 40 years ago had very favorable concessions. They spent a very great deal of money and developed a very great deal of oil. Then a few years ago the Iranian Government said to them, "We want a new contract with you."

They did not claim that the company had not lived up to it. They simply insisted on renegotiating. It was renegotiated at terms very much more favorable to the Iranian Government.

Then about 2 years ago they did it once more, and they are now once more renegotiating or re-renegotiating. Likewise, something similar has happened in Venezuela; it has happened in Saudi Arabia, and it can and undoubtedly will happen in every one of those foreign countries.

Senator LONG. Mr. Ickes spoke the other day of what a fine bargain the Shah was able to make over in Arabia. He said that he has shown himself able to get more than the average state could on their leases with the Federal Government, and he is only an ignorant Arab. Of course, there is a point to think of that the Shah was in position to tell the oil company, "Either you give me the kind of contract I want or get out and leave your wells here."

Mr. JACOBSEN. That is right, and that, of course, is another one of the very important elements that tend to make this so-called very cheap foreign production much less cheap than it is supposed to be and less cheap than it was a few years ago.

Senator ANDERSON. Are you suggesting that now, when this country seems to need revenue, it should renegotiate?

Mr. JACOBSEN. To the best of my knowledge the Treasury Department is constantly trying to renegotiate.

The CHAIRMAN. Are you speaking of the depletion allowance, sir?

Mr. JACOBSEN. No; I am talking about income tax.

The CHAIRMAN. Now, we have had some interesting information from the oil industry. I think, perhaps, the time has come for somebody to speak for coal.

If you turn to page 8 of Senate Document No. 8, Basic Data Relating to Energy Resources, we find some rather interesting information. In 1949, according to the tentative figures for that year, coal produced 39.8 percent of the total energy consumed in the United States; petroleum produced 33.8, and natural gas, 18.7 percent.

Ten years before in 1939 the ratios were: coal, 51.4 percent, which, of course, was vastly greater than it is now; petroleum, 32.3 percent,

1.5 percent less than it was in 1949; and natural gas, 11.7 percent, or 7 percentage points less than in 1949; and in 1929, 20 years ago, coal was 63.4 percent, petroleum only 23.3, and gas 8.2 percent.

I cite those figures so that we may have them in mind as I call on Mr. Earnest to make some comment on this situation.

Mr. EARNEST. My name is Frank W. Earnest, Jr. I am president of the Anthracite Institute, whose principal office is located in Wilkes-Barre, Pa., and which represents producers of more than 80 percent of the annual anthracite tonnage.

In 1950 our industry produced 42,000,000 tons. Our principal markets are in the States on our eastern seaboard, the Canadian market, and in the Lake States area. Approximately 75 percent of our production is used in the heating of 5,000,000 homes, and the balance is used by public utilities, Army, Navy, and in commercial and industrial establishments.

I want to assure the committee that we fully recognize our industry's responsibility in meeting its own marketing problems. However, as our industry is in direct competition with oil and gas, it is only natural that we have read and studied many statements made by Government officials, prominent oil and gas executives, and geologists, many of whom agree that the Nation must, in the not too distant future, depend upon solid fuels to supply more of its energy requirements, due to the fact that in a few years the Nation's consumption of petroleum will exceed its productive capacity.

Now at this point I intend to read some of the statements, and I think you referred to them as gloom statements, but you have already read into the record the one from the Munitions Board and also by Mr. Ayres, and I would only comment on some of these statements and then just take the time, and I will be very brief, to read one or two more.

It seems to us in the coal industry that at least many of the statements that have been made by prominent people in Government and the oil industry do not agree with some of the statements made here today, but, for example, in the economic report of the President:

> A sound conservation policy should encourage the use of water power and coal as against the more quickly exhaustible oil and natural gas.

And as Dr. Fieldner of the Bureau of Mines said just last fall:

> Another World War will change this picture. If it occurs, petroleum and its products will be in short supply, and much conversion to the use of coal will be required for both industrial and domestic use.

Then, on the question of the ability of the oil industry to produce, Mr. George Hopkins, of the National Security Resources Board, said:

> In summary, the oil fields being found today average but a fraction of the average size of, say, 25 years ago. Many of the new discoveries will be too costly to operate, or at least to develop to the point of recovering all the reserves. Three percent of the fields and pools supply one-third of the present production. In a comparatively few years the decline of the old fields will be greater than the increase from new discoveries.

Then by Mr. DeGolyer, oil geologist:

> There is nothing in the past history of exploration and nothing in the remaining prospects as far as we know them to justify a belief that we can find on averages 2 billion barrels of oil a year. I think if we can find a billion barrels of oil on averages we will be doing excellently.

The anthracite industry has been losing substantial tonnages to oil and gas at a rate which, if sustained for many more years, would reduce the annual production of anthracite to a point where the large anthracite reserves, for all practical purposes, would be of little importance. Unemployed and semiemployed miners will not stay with the anthracite industry, particularly with other industries looking for manpower and, accordingly, will not be available to produce anthracite when the emergency, which authorities concede is inevitable, arises.

We cannot add new men to our payroll quickly, as in our industry a man must have worked at least 2 years as an apprentice and pass a State examination before he is granted a certificate as an anthracite miner.

I feel—and have this short clause to read—that the meat of this whole question is, if we refer to the monograph and the page, Mr. Chairman, that you just read—table A–3 on page 8, and the figures that you quoted—it is evident that during 1949 petroleum and natural gas supplied 55.3 percent of the Nation's energy ,while coal supplied 39.8 percent. On the other hand, table H–16, on page 167, shows that petroleum and natural gas constitute together 3.82 percent and coal 83.06 percent of the Nation's total assured recoverable mineral-fuel reserves. We submit that this represents a serious unbalance of the Nation's use of its mineral-fuel resources and a serious matter which this committee very properly is investigating.

The anthracite industry will do its utmost to serve the country in any emergency that might arise. It would be better prepared to serve the country if peacetime production were such as to encourage the retention of its manpower and the development of its reserves. If it is true that fuels now supplying 55.3 percent of the Nation's energy are so limited as to constitute only 3.82 percent of the Nation's fuel reserves, we trust that the Nation will awaken to the fact in time to keep its coal industry strong.

We sincerely hope that these hearings will help to formulate a national fuel policy. If it is determined that there is sound basis for conservation of the Nation's petroleum and natural gas reserves and a correspondingly greater use of its solid-fuel-reserves, we should like to be so apprised. On the other hand, if it is demonstrated to your satisfaction that there is a sound basis for the Nation's continuing to use its oil and gas reserves as it has been and with no change in what seems to be the wasteful practice of using oil and gas for nonmobile purposes, the sooner the anthracite industry obtains this information the better position in which it will be to plan for the future.

The CHAIRMAN. What do you mean by the "wasteful use of petroleum"?

Mr. EARNEST. We mean using petroleum for domestic heating—pretty much in line, I think, with the statement of the Chairman of the Munitions Board—where coal is available in large quantities, at a lower price in many cases, and with the automatic equipment available today to burn it. Mr. Jacobson made quite a point about the ability to produce as being the important point. I go back to World War II where our industry was forced, in the public interest, into the position of taking on a substantial amount of oil business and when

we did it was necessary to ration the amount of coal that our 5 million customers were using to a point that, while I am glad to say we took care of all our customers, we had a very large additional load thrown upon our shoulders.

It seems to us if these figures are correct and the large reserves that exist in coal and the comparatively limited reserves of oil and gas that some of the statements made are a hope insofar as new discoveries are concerned. We, as an industry, are very conscious of the reserve situation and are considering not only the protection of the markets we have, but are looking to the future to keep our mines strong so that we are ready to take up this load when it appears.

The CHAIRMAN. Mr. Earnest, it will be noted from the table on the page from which I cited figures that anthracite contributes a very small percentage of the total, a small percentage of the total coal contribution.

In 1949, according to this table, Pennsylvania anthracite contributed only 3.4 percent of the Nation's coal consumption, that in 1939 the percentage was 5.8 and in 1929 was 7.5.

Mr. EARNEST. Yes, sir.

The CHAIRMAN. That shows a constant decline. That is graphically illustrated by the chart on page 7 on which anthracite appears at the bottom of the chart.

The whole coal contribution, as I indicated, has dropped from 63.4 in 1929 to 39.8 in 1949, and the anthracite from 7.5 to 3.4. Does that indicate a falling off in reserves also?

Mr. EARNEST. No, sir.

The CHAIRMAN. What about the reserves of anthracite coal?

Mr. EARNEST. I would rather Mr. Taggart would speak on the question of reserves. Mr. Taggart is here. I would rather he would speak on that.

The CHAIRMAN. Very good.

Mr. EARNEST. But I would like to just make one point, Senator, before he does. I think your question had two or three points to it.

Insofar as our size is concerned, we are still—I want to emphasize that—a very important factor in the eastern markets, New England and in Canada in the domestic home field. In other words, we heat as many homes regardless of the tonnage we have lost, as oil, in our major marketing area. I just want to make that point.

Mr. WILSON. Mr. Chairman, before we leave Mr. Earnest, I would like to be clear as to whether he seriously proposes that the Federal Government should tell the individual home owner what kind of fuel he can use. That seemed to be the implication of his statement.

Mr. EARNEST. That is not the implication at all, sir. I am merely pointing out the facts that I thought were spelled out in the resolution itself, and then it is up to this committee to decide what can be done with it, what should be done with it.

I am not implying that anything should be done. Perhaps the oil industry itself should do something about it. I do not know, sir. I am merely pointing to the facts.

Senator LONG. Mr. Wilson, are you speaking for the oil industry or the gas industry?

Mr. WILSON. Either one. I am speaking primarily for freedom.

Senator ANDERSON. Mr. Chairman, I am just wondering if Mr. Earnest has any theory as to why he has lost his market.

Mr. EARNEST. We have lost it unquestionably because of the convenience factor of oil and gas. There is not any question about that. We have no hesitation in saying, however, today that we feel we have made great progress along research lines. I think we have been handicapped at times with the seriously low prices of oil.

Senator ANDERSON. Do you think dependability of delivery has had anything to do with it?

Mr. EARNEST. Insofar as the difference between coal and oil is concerned?

Senator ANDERSON. Yes.

Mr. EARNEST. No, sir. Not in our anthracite markets. Are you referring to a cessation of operations, for example?

Senator ANDERSON. Yes.

Mr. EARNEST. I think that is misunderstood, sir, in this country. We have had some threatened shortages possibly of coal, but I do not know of any industry in America that did a greater job in production without any subsidy of any kind than the coal industry, both bituminous and anthracite did in World War II, and to my knowledge there has not been any interruption of production and no loss of heating in homes due to any shortage of coal. There might have been an isolated spot, but also those shortages existed in oil no less than 2 years ago.

Senator ANDERSON. Do you think that has had anything to do with the number of changes in railroad use, or is that due purely to the desirability of Diesel-type locomotion?

Mr. EARNEST. I referred to an actual oil shortage in the eastern markets which may—I do not know the answer, but I know that in many communities oil was not available, and I certainly know in World War II oil was rationed to a greater extent than anthracite.

Senator LONG. I wonder if we are all thinking about the same thing. It is my impression that during some of these strikes people simply could not get coal to put in their burners. Now that may not be true, but that is the impression I had.

Senator ANDERSON. That is what I thought.

Senator LONG. The press may not always be reliable. Sometimes I am sure it is not, but that is the impression I gained.

Mr. EARNEST. There are other coal representatives here that can speak, and if I am not dealing in facts I can assure you I want to, but I do not know of any shortages that interrupted production in any way that were at all serious during any——

The CHAIRMAN. Mr. Earnest, are you speaking of anthracite or of coal in general?

Mr. EARNEST. I am being presumptuous enough to speak for both, but there are bituminous representatives that may speak for themselves, sir.

Senator LONG. Is it your position that in those strikes John L. Lewis never got you down to the point where you were not supplying your regular customers with the coal that they needed for home heating?

Mr. EARNEST. As far as anthracite is concerned, I do not know of any case since 1924 where anthracite customers did not have sufficient fuel to keep warm.

Senator LONG. Bituminous also?

Mr. EARNEST. I cannot answer that for bituminous.

Senator LONG. What is your guess for bituminous?

Mr. EARNEST. Let bituminous answer the question.

Senator ANDERSON. That is the whole point of my question.

Mr. POTTER. There was a shift to other fuels during the period of suspension in bituminous, primarily to maintain stockpiles at industrial points. A typical example of that would be a utility company.

You see, bituminous coal is primarily industrial. It would be the utility company that would have substantial stockpiles of coal and yet they could not afford in the case of a coal strike to not try to get some other fuel and conserve that pile of coal in the event that storms or other things at sea would delay shipments of oil, because there is no oil storage at seaboard for those particular industrial plants.

Therefore while you might infer that people ran out of coal, that is not so. They maintained those stockpiles and shifted to other fuels.

Senator ANDERSON. There is such a thing as oil storage at seaboard is there not? I listened to radio programs here in Washington and have been hearing a lot about how much oil is stored by one individual alone.

Mr. POTTER. Not in terms of term operation, sir. A few days is a pretty big oil storage for a utility.

Senator ANDERSON. I asked my question because I had the feeling that there might have been some shift due to insecurity, and I have been reading in a home newspaper where the school board in my home community, having had some difficulty with natural gas, is now talking about going back to coal because they thought it might be more reliable for a while. Do you not think that reliability of fuel supply is a very important factor?

Mr. POTTER. I think it is extremely important, and bituminous coal operators as a group in the past couple of years—I will admit it is a little late—have tried to adopt that policy and have been working with labor for a change.

The CHAIRMAN. The table on page 8, beginning with the year 1899 shows a steady fall in the percentage of coal with relation to the total use of fuel in the United States. In 1899 the total coal was 89.1 percent, the total petroleum 4.5 percent, the total natural gas 3.2 percent, and the total therefore for all mineral fuels was 96.8, leaving 3.2 percent for water power.

Now the over-all record then of 50 years has been a steady decline in percentage for coal, a steady gain in percentage of domestic production for petroleum, and a steady gain of natural-gas production in the United States.

There has also been a slight gain of water power, and it would appear on the surface, at least that this falling off of the percentage which coal contributes to the total supply is due rather to the convenience of the other fuels than to any other reason. Do the coal representatives agree on that?

Mr. POTTER. I do not, sir.

The CHAIRMAN. What is the point of view as you see it?

Mr. POTTER. Mr. Chairman, the United States is living primarily on a mobile economy. These particular reserves——

The CHAIRMAN. What do you mean by "a mobile economy"?

Mr. POTTER. Automobiles. That is a typical example. Tractors is another example. This particular table shows the British thermal unit equivalent of usage. Now in all fairness to the petroleum industry, we in the coal industry do not make gasoline. The biggest

increase in the use of automobiles naturally increases the percentage of B. t. u.'s used by the coal industry, so that we cannot just look at this particular table and say that the coal industry has lost a big portion of the energy market due to labor or cost of coal.

The CHAIRMAN. No. I said to convenience. You cannot burn coal very well in an automobile.

Mr. POTTER. That is right.

The CHAIRMAN. And you must have liquid fuel.

Mr. POTTER. That is correct, sir.

The CHAIRMAN. Now if we make liquid fuel out of coal, then coal would have a growing percentage of the mobile market, would you not say?

Mr. POTTER. That is correct, sir.

The CHAIRMAN. I want Dr. Potter to make clear his answer. Do you still disagree with the conclusion that I drew from this chart that it is the convenience rather than anything else that has displaced coal?

Mr. POTTER. I did not understand your usage of the word "convenience." I thought you meant like hand usage and so forth.

I agree with you, sir.

Senator LONG. What Dr. Potter meant was that the loss has not been so great in the established markets for coal as much as the increase in petroleum has been due to new uses, for example, the increased use of transportation facilities.

The CHAIRMAN. In this compilation of basic data we have somewhere a table showing the annual production for each of these fuels. If Mr. Sandusky will find that, we will put it in the record here.

Mr. WILSON. Mr. Chairman, you were asking about the anthracite reserves. I see those are given on page 167 of the committee monograph, and that indicates that the anthracite reserves of the country are only 0.57, or slightly over one-half of 1 percent of the total fuel reserves of the country and they are producing at the rate of 3.4 percent, so they are producing about 10 times as large a proportion of their reserves as the bituminous coal.

On the theory that you should ration use according to reserves, it would seem that the logical thing to do is to cut down the use of anthracite and insist that bituminous be used in its place, because they have so much more reserves, about 100 times as much.

The CHAIRMAN. Who proposes the rationing of use on the basis of the amount of reserves?

Mr. WILSON. Mr. Earnest said that he thought there was too much oil and gas being used in household heating, because the reserves are so small.

Senator ANDERSON. In fairness to Mr. Earnest, it seemed to me that he was suggesting that we had a large supply of coal in this country and it would be a desirable thing—he did not say it was a fair thing, but he said it was a desirable thing—to use it and I agree with him on that point of view.

Mr. WILSON. I have no quarrel with that.

Senator CORDON. Your view is, however, that with reference to anthracite they are using it and are using it proportionately higher with respect to reserves than other fuels.

Mr. WILSON. Ten times as high as bituminous.

Mr. TAGGART. How does that compare with oil or with gas, either one, as compared to the discovery and——

Mr. WILSON. It is about 10 times as high as bituminous, and a little less than half as rapidly as petroleum and natural gas together. That is for the year 1949.

I do not happen to have the figure for oil and natural gas separately, but taking the two together, that is the ratio.

Mr. TAGGART. The time element then must be considered along with all of these propositions?

Mr. WILSON. Surely.

Mr. TAGGART. That applies to the production rate at which we are using our oil and gas and our bituminous coal and our anthracite and any other fuels that we have, mineral fuels, that we have?

Mr. WILSON. I do not know just what you mean when you say "that applies."

Mr. TAGGART. We were talking—Mr. Jacobsen, I believe, was talking—about the ability to produce, about the ability of this country to produe oil and gas and liquid and gaseous fuels in the event of an emergency. I would like to hear comments on the extent or the period of the emergency and for what period of time are we talking about. I am impressed with the figures that come from the Department of the Interior that say we have known discoveries of oil for 14 years and of gas for 28 years.

Mr. WILSON. And that is about the same as it has been for the last 20 years, roughly speaking.

Mr. TAGGART. And the rest is what we may subsequently discover. Now, then, does it not appear plausible that we should get to discovering this oil or to do something relative to gas, prepare for synthetic fuels, or something like that if our economy is based on oil and gas, or our defense is based on oil and gas?

Does it not appear logical that we should now be looking, as this committee is, to a solution of that problem and at what to do about it? If we have only that much, what should we do about it?

Mr. WILSON. It is certainly very important that we continue a rapid rate of discovery of oil and gas as we have been doing over recent years. We should be particularly careful not to interfere in any way with the incentives which have led to that rapid discovery, and which as a matter of fact, have resulted in our substantially increasing our proven reserves, whereas the coal estimates of proven reserves have been going down, as the Senator mentioned.

Mr. TAGGART. By recalculation, and a good bit of the proven reserves of oil, if I remember the books properly, are by recalculation too and not by the discovery of new fields. Is that correct or is that wrong?

Mr. WARREN. I may have something to say on that, Senator.

The CHAIRMAN. Mr. Warren.

Mr. WARREN. For the 9 prewar years 1.62 barrels of oil were found for every barrel produced. During the 4 war years 1.13 barrels were found. That was when we had restricted drilling.

In the 5 years since the war the rate of discovery—this is averages—has been 1.65 barrels or a little better than the 9 prewar years rate.

Mr. TAGGART. Is that new discovery or is that expansion of old fields and everything taken into consideration, reestimates, and so on?

Mr. WARREN. That is in addition each year, but taking the averages that result in new discoveries.

Mr. TAGGART. I do not know anything about it, but what I read in the book.

The CHAIRMAN. Mr. Jacobsen I think may have an answer.

Mr. JACOBSEN. Yes; I would like to say a couple of things. First, when we talk about the reserves of 30 billion barrels of oil, then that covers only the actual definitely proven reserve now available for production within definitely proven areas of the various fields.

We know perfectly well that those fields will produce more, and one reason why in all of these compilations each year such a large proportion of the addition to reserve appears to come and does come from previously found fields is this: It is very seldom that a new field, if it is of any importance at all, will have shown its capability to produce and its size at the end of the year.

For instance, a certain field that may ultimately produce say 300 million barrels of oil is found, say, in the month of July. By the end of the year there may be four wells producing in that field. The area proved by those four wells may produce, say, 10 million barrels of oil.

That field then, if found in the year 1950, will go into the 1950 compilation with only 10 million barrels of oil, although we know that it will produce considerably more, but nobody can tell how much more until additional wells have been drilled. Therefore, in this hypothetical case, at the end of the year, this field will go into new discoveries with only 10 million barrels of oil.

During the following year 100 wells may be drilled in that field and may have proved that 100 million barrels will be produced. Therefore, in the following year there will be an addition of 90 million barrels due to revision of earlier estimates.

It is not just juggling bookkeeping where you take old figures and make them look bigger. It is because all of these estimates are made on a very conservative basis.

The CHAIRMAN. Mr. Jacobsen, I think the point that Mr. Taggart was trying to make was that a substantial portion of the increased estimate of reserves is due to precisely the condition that you have described, namely, the extension of old fields, and he was asking what proportion of this increase is due to the discovery of new fields which were not in previous computations.

Senator ANDERSON. Is it not true that it is not just exactly the extension of old fields. It is the fact that one well went down in the center of an area and all you can take is that one well and say that is all that has been proven by that. You subsequently spot four wells around it and you know in your own mind that you are going to be able to produce 40 wells.

The CHAIRMAN. The word "extension" is used to mean the extension of the proven reserve in the field. You might have the geological boundaries of the field and yet you would not know until you tested out to the boundaries whether or not it would actually be producing at the edges.

Senator LONG. Actually the soundness of that analysis would depend upon whether you are able to keep up your rate of new discoveries. Now are you able to keep up that rate of new discoveries?

Mr. JACOBSEN. That is right, and that is the way we have been able to do it hitherto. I have a short compilation here that I got the other day showing estimates of reserves made at various times.

In 1922 the United States Geological Survey made an estimate to the effect that we had 5 billion barrels of reserves. That was 1922 proved reserves. In 1925, a committee of the American Petroleum Institute estimated 5,300,000,000 barrels. The Federal Oil Conservation Board in 1926 figured that we had 4,500,000,000 barrels. Now we have 30 billion and in the meantime we have produced probably 27 or 28 billion barrels.

In other words, we have been able to do the very thing that you mentioned, Senator.

I would also like to say when we talk about these reserves, that in this compilation prepared by your committee it is plainly pointed out that the estimates of oil reserves are, for the reasons which we are talking about, definitely on the conservative side. The booklet also points out that the coal reserves are based on figures that are 30 years old, and that they have proved to be very much too high. There is an example given in here, and I am sorry to say that it is Wyoming, as they might have picked another State.

The CHAIRMAN. They are always picking on my home State.

Mr. JACOBSEN. Except the oil industry. We find oil there.

The CHAIRMAN. I beg your pardon, what did you say?

Mr. JACOBSEN. We find oil in Wyoming.

The CHAIRMAN. I thought you said you do not.

Mr. JACOBSEN. Seriously, this book cites the case of Wyoming as an example of how very greatly overestimated the coal reserves have been.

The CHAIRMAN. But I must point out that in that instance the Geological Survey in making this new estimate which reduced the figures for the State of Wyoming, explained that it had omitted 53 percent of the area of the State from the new estimate because of inadequate mapping and exploration. The whole area of the State had been included in the first estimate, so I do not accept the reduction as the final word.

Mr. TAGGART. Mr. Chairman, on the reduced figure and the recalculation, there is still approximately 500 years of coal, I understand, at the very lowest estimate. It may run somewhere between that and 2,000. In other words, we are measuring it in centuries. The oil reserves and the gas reserves we are measuring in years.

The CHAIRMAN. May I interrupt you, Mr. Taggart, just for this purpose. I want the press particularly not to be misled by the discussion we have had about the declining contribution of coal to the total fuel picture. That does not mean a decline in the production of coal in the United States.

The figures on that will be found on pages 75 and 78. In 1939 the production of anthracite coal was given as 51,487,377 tons. Of bituminous and subbituminous 394,855,325, making a total of 446,342,702 tons.

In 1939 that constituted 51.4 percent of the total picture. In 1949, however, the production of anthracite was 42,701,724, falling off by the way, but the production of bituminous had increased to 437,-868,036 tons, or a total of 480,569,760 tons.

Therefore, in the 10-year period the total production of coal had increased by approximately 34,000,000 tons, but the percentage had declined from 51.4 to 39.8. I wanted the record to be clear on that point.

Now, Mr. Taggart, I apologize for interrupting you.

Mr. TAGGART. I had finished.

The CHAIRMAN. You were in full flight when I interrupted.

Mr. TAGGART. I had asked some questions.

The CHAIRMAN. Mr. Battle.

Mr. BATTLE. Senator, I am glad you pointed out the figures on page 8. I want to supplement your remarks with the fact you had previously put in the record, that in a 50-year period the population had about doubled, and the record proves that coal was less than half from a percentage standpoint.

There seems to be a considerable difference of opinion among the oil experts about what they have got and what they hope to get. There is not any difference of opinion among our bituminous representatives.

To save your time and the committee's and everybody's, we have been conferring on this matter and we have here practical coal men and I am going to ask that Dr. Potter make the main presentation. We are here to support him and answer any questions on the bituminous coal situation.

The CHAIRMAN. Very good. Dr. Potter.

Mr. POTTER. Mr. Chairman, in response to your letter asking us to this meeting, we had assumed that there would be two major questions raised at this meeting. One, is a national fuel policy necessary and, two, if a national fuel policy is necessary, what shall the policy be?

To that end, the determination of No. 1, that is, is a fuel policy necessary, I think that the answer to that is whether there are ample reserves and ample productive capacity of all the fuels and energies that we have.

If we have ample reserves and ample productive capacity, the basic laws of economics will operate and we should not be here. If we do not have ample reserves and ample productive capacity, the people of the United States should give serious consideration to a fuel policy. That fuel policy, as I say again, will have to be determined in light of reserves.

Now it is quite significant that in times of peak demand in this country that there has not been enough oil and gas to supply the markets which they have taken. We do not know whether that is simply reserves or whether that is productive capacity, but it seems obvious to us that it is both for the reason that United States corporations have been making extremely large expenditures outside the continental limits of the United States.

There can only be two basic reasons for that. One would be economic and the other necessity to find the oil. We do not know which of those two are correct. We think that we should know, we think that the people of the United States should know.

Indications here today point out that the reserves are not the basic problem but the ability to produce is the basic problem. If the ability to produce, and I might add "find," is one of those problems, then we in the coal industry have a perfect right to find out what we are going to be called on for in the future and what the people of the United States want us to do.

We do not think it is fitting and proper in the case of each and every emergency that comes up to say, "All right, coal, you take it

all," irrespective of what happens. To that point, we cannot supply our customers with great volumes of coal in times of emergency if in normal times our markets are subject to raiding, nor can the economy of the United States in wartime or in a preparedness program such as we are undergoing today, be improved by the importation of certain types of oil that are coming into the United States.

These particular oils, a great number of them that are being imported, are being burned directly under large boilers and are of no use whatsoever to the military. We think we are entitled to find out those things, and if they are as the coal industry believes, we think that a national fuel policy of some sort is justified. If we are wrong, then we should go home.

The CHAIRMAN. A suggestion of that kind would mean a positive intervention by the Government by way of law with the utilization of fuels, would it not?

Mr. POTTER. It would, sir, and I am opposed to that unless the requirements of the United States are as I have named.

Senator LONG. Certainly you have a point to this effect. If it appears that during wartime we would not be able to get sufficient supply of fuel in terms of oil and gas, possibly we should give some consideration to whether new facilities should be designed to burn coal instead, in view of the fact that oil might not be available.

Mr. WILSON. We have some information on that.

Mr. POTTER. I want to make one more point; that in time of an emergency the coal industry produces through its end products the most critical items the United States requires, and that the pressure of the other fuels on that entire program has been such that it is definitely retarding the defense program of the United States today.

The CHAIRMAN. I hear nobody yet in the round table responding.

Senator LONG. How far can you go in coal production with improved mechanical devices? How far have you gone with that?

Mr. POTTER. We are actively engaged in the development of continous miners. I think that is what you are speaking of, or labor-saving devices. We have them in operation and have had them in operation for approximately 2 years.

We are at the point where it is a mechanical problem and not a problem of the development or what kind of a machine to make.

Senator LONG. Are you receiving cooperation from the unions on that?

Mr. POTTER. Perfect cooperation. I cannot speak for the unions, but they have recognized that the operator is entitled to produce coal as cheaply as possible and to use all the labor-saving equipment possible and they are entitled to reasonable living standards.

Senator LONG. They seem to realize in the long run that means higher wages and better living standards.

Mr. POTTER. They do, and that is the policy.

Mr. JACOBSEN. As I understand it, it is your suggestion in effect that the Government should step in and say to certain industries or certain communities, "You have got to use coal. You have got a natural gas line at the city gate, but you have got to use coal," or you would have to go to house owners and say, "you are burning gas or oil but you should burn coal," or there is a new addition being built of thousands of houses where they had intended to put in oil

or gas burners and then the Government says, "No, nothing doing, you have got to use coal." That is what it comes down to.

Mr. POTTER. Not specifically that, Mr. Jacobsen. What I am referring to is if there is a shortage of fuels in the United States, something should be done. I have made no suggestion that you tell a domestic consumer or tell a public utility what to do. There are other ways to do that.

Mr. JACOBSEN. How?

Mr. POTTER. Let me give this case as a point and I want you to bear with my ignorance with respect to petroleum refining, sir.

Mr. JACOBSEN. It is equalled by my ignorance of coal.

The CHAIRMAN. We have an educational session going on here.

Mr. POTTER. There are heavy quantities of residual fuel that move into the eastern seaboard and displace coal under steam boilers. Many refiners crack that residual up to the mobile use products. Residual has sold at prices way under the cost of purchase of a barrel of crude oil.

Is there not more money in the refining from a profit standpoint, refining of that particular product to the product that people of the United States want? I think the answer to that is "Yes," but I think the reason you do not do it is because it would curtail the volume of your business.

Mr. JACOBSEN. The reason is purely economic, but I do not see that even if you start with your premise, you would save any oil because the oil you are talking about comes from abroad, and—again, I am speaking just from your premise with which I do not agree—I cannot see that stopping the importation of foreign residuals, which you claim take the place of coal would in any way keep us from using the quantity of domestic oil that we now do. It simply becomes a question of coal versus residual oil brought in from abroad.

Mr. POTTER. You say the problem is simply one of coal versus residual oil from abroad.

Mr. JACOBSEN. Yes.

Mr. POTTER. If we assume that there is a shortage of oil? I did not attempt to make the assumption that there was. I said you should determine whether or not there is a shortage of productive capacity in the United States, and if there is a shortage of productive capacity and reserves in the United States, and it is apparent that that is so, because of the huge capital expenditures made abroad, and you want the coal industry in the future to take care of your emergencies, then you have got to do something about it.

We do not like to have it dumped in our back yard as an end product to progress in foreign development.

Mr. JACOBSEN. The point is, as I understand you, that you must first determine if there is a shortage of producing capacity, because that is the premise on which your statement is built.

Mr. POTTER. That is correct, sir. Then reserves.

The CHAIRMAN. Of course, one of the primary facts which this committee will endeavor to obtain is the exact status with respect to reserves of all of these fuels.

Mr. BATTLE. So that the record may be clear, let it show that the bituminous coal industry is in a position to take care of a 20 or 25 percent increase in energy requirements if called on to do so to meet the needs of this Nation. It can do that now, always provided, of

course, that we are not crippled with our manpower—that is not the case at the moment—or some other unforeseen eventuality. We can do that.

We do not have too great a difficulty meeting domestic production oil. Our difficulty is meeting this foreign dumped oil, and I note the absence of the independents here, independent oil producers, because they have always been in our corner against this dumping of the foreign oil.

In trying to get some relief they have always claimed—I suppose they can speak for themselves—that they had the ability to produce here and objected just the same as we have to these foreign imports.

The CHAIRMAN. Mr. Battle, the independents are not unrepresented. Your opposite number at the other end of the table, Mr. Warren, represents the independents.

Mr. JACOBSEN. That is a slight to me. I have done more yapping here than anybody else, and I am one of them too. The company that I represent is solely a producer of crude. We have no refinery, no filling stations, no pipelines, and we do not import any oil at all.

The CHAIRMAN. Mr. Jacobsen. I am afraid I have to strike part of your remarks from the record. I have listened to you testify on many occasions, and I have yet to hear you engage in any "yapping." Your testimony has always been right to the point.

Mr. JACOBSEN. Thank you, sir.

Mr. WARREN. I might say, Senator, I do not think we are in Mr. Battle's corner. We have taken a position against imports when we felt it was injurious to our domestic industry.

The CHAIRMAN. That raises a very interesting point. The independent petroleum producer has taken a position against imports?

Mr. WARREN. Not against imports but in quantity that would be injurious.

The CHAIRMAN. I have not quite finished my sentence. A position against imports when in the opinion of the independent those imports were injurious to the production and the marketing of the product of the independent petroleum producer.

Now you have a representative of the coal industry making the same argument, but not against imports, but against domestically produced petroleum and natural gas which according to his view is having the same effect upon the coal industry as imports of crude petroleum in the opinion of the independent producer of petroleum had upon the market for the independent.

Mr. BATTLE. Senator, I think you must have misunderstood me. I said we have no quarrel and we can fairly meet American-produced oil in the markets.

The CHAIRMAN. Then you are just complaining about the importation of oil.

Mr. BATTLE. Dumping this foreign oil, absolutely, and we have always had the help of our independent friends.

The CHAIRMAN. That explains why you said that the independent petroleum association is in your corner.

Mr. BATTLE. It always has been. I am sorry if he is drifting away a little bit there now.

Mr. WARREN. I am stating my position that we have taken the position that imports should be coming in only to supplement our domestic production and not to supplant it.

Mr. BATTLE. Then you would like to have them restrict it to the ordinary 5 percent that we have always been asking for, is that correct?

Mr. WARREN. No, sir. I would not say that at the moment. I think that the imports at the current rate may be a little bit high, but they are not supplanting our domestic production at this time.

Mr. POTTER. That is not true as far as coal is concerned.

Mr. BATTLE. Is imported oil now supplanting your production, supplementing the production of the independent producer?

Mr. WARREN. It is in relative amounts, but I would say now that the domestic petroleum industry is in a rather healthy condition. Our philosophy on this has been that we have to keep up our ability and when the ability is injured in the domestic industry, that is when we object to any imports above that point.

Mr. BATTLE. Then it is a matter of economics, and as I get you, as long as you can sell what you produce here, we cannot expect any more help from you on the importation question. Is that a fair question?

Mr. WARREN. I am not speaking for the entire independent petroleum industry, but am just giving you my opinion. Our position has been for our own domestic petroleum industry, when those facts, figures, and conditions are existent, that probably when it does arise we certainly would be fighting excessive imports.

The CHAIRMAN. May I ask Mr. Warren if we are to understand the position of the independent as being this: That when the market in the United States is so great as to consume all that the domestic independent procucer can produce, all that the domestic petroleum industry can produce, and all that can be imported, then there is no division in the petroleum industry, but when the market in continental United States falls so that imports are taking away some of the market of the independent, then the independent separates from the rest of the industry?

Mr. WARREN. That is a nice question. What I wanted to say was that our philosophy has been our ability to go out and find and search for new oil and stay in business and increase our technology and have an equitable opportunity in the market. That is what in my opinion—I am speaking for myself alone—that is what the independent oilman of the United States is fighting for. When imports injure our domestic situation, why we are opposed to it.

The CHAIRMAN. I remember more than a few years ago when the domestic petroleum industry was fearful of petroleum imports. Great agitation began and were successfully carried through for an increase of the tariff on imported petroleum, the purpose being to make it more difficult to bring petroleum in, so that the domestic industry would not be injured by that importation.

In principle and in logic I can see no difference between that attitude and the attitude that is here expressed by the representatives of the coal industry, certainly so far as imports are concerned.

Mr. BATTLE. Except, Senator, it is a fundamental principle with us importing this foreign oil and dumping it. With many it is apparently just an expedient when we can do all we can do here, it does not make any difference how much you bring in, so we seem to have lost our ally in part in that respect.

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Mr. POTTER. I do not agree with that. I will show you the coal industry is divided also. Go ahead.

Mr. WARREN. I want to qualify that. The independent, the IPAA, the association that I represent has as its national oil policy that petroleum imports in excess of the amount to supplement the domestic production should be prevented and that has been our position all along.

Senator LONG. Might I ask this double-barreled question on a new basis of discussion. Does anyone see any reason why we ought to make any effort to curtail the use of petroleum and gas, as long as the new discoveries of reserves exceed the amount used year by year?

Mr. WILSON. That is certainly a critical question, and I think we are prepared to give an answer to that.

Mr. TAGGART. I would like to address myself to that question, if I might.

The CHAIRMAN. Very good, sir.

Mr. TAGGART. I am becoming considerably enlightened and particularly confused at the arguments that are going back and forth on this proposition.

The CHAIRMAN. Now you can understand the dilemma of a Member of Congress.

Mr. TAGGART. I can understand that very well. I thought the proposition that was provided for in the resolution was to determine whether or not there was sufficient oil, gas, coal, and any other mineral reserves to support our economy in times of peace and in times of war. It certainly is not the attitude of the anthracite industry that they want to tell any householder what they should burn.

There are other fuel policies that perhaps can be developed in this country, if it is to the point and the Secretary of the Interior would indicate that it has reached the point, as other things that I have read would indicate, that new discoveries are not as much as present consumption.

If those statements are not a fact and if we can rely indefinitely for a reasonable period of time that our discoveries, our new discoveries of these gaseous and liquid fuels are going to meet the demands of this country in times of peace and in times of war, why I think the committee has very little to find except that economics will take care of the proposition. I do not get that from these tables that I have seen.

If the 14 years of oil can be relied upon or reasonably close to 14 years, if 28 years of gas can be reasonably relied upon, it does not necessarily mean that a householder cannot burn gas or that he cannot burn oil.

It does mean maybe that if the reserves of gas and oil in their natural state are in such a diminishing amount, it may be necessary to seek other forms that can be converted into oil and gas that can be used for the convenience purposes that we think are necessary for mobile power, heating and everything else. It refers to the recovery of oil from shale.

It is known I think, the technology is known, as to how to reduce natural gas to oil or to liquid fuel. That technology is pretty well known.

When you come into the gasification of coal, although experimentation is going along that line, maybe that should be accelerated if we have a great amount of it. Maybe we should seek other forms.

Maybe our technology should be increased. Maybe the Government should devote its attention to that. Maybe the foreign oils will be cut off from us in one day, who knows.

What is going to happen to our transportation system? During the First World War—and I am sorry to say that I can remember the First World War—the difficulty in the coal supply was not a difficulty in producing coal but it was the transportation facilities. We cannot expect the railroads to stay in a stand-by condition and only supply cars when we are in an emergency. We cannot expect them to keep in that position. Also the mines will be flooded and so on.

We have a real problem here. If our gas and if our oil supply is in such limited amount as the tables seem to indicate that it is, are we going to run along and never miss the water until the well runs dry, or are we going to do something like we did in rubber? Are we going to have some synthetic fuels that will serve as a replacement? I think that is the problem that we have to approach.

Mr. JACOBSEN. Mr. Chairman.

The CHAIRMAN. Mr. Jacobsen, I was going to ask Mr. Kayser to step into the picture at this time.

Mr. KAYSER. I would rather hear Mr. Jacobsen.

The CHAIRMAN. All right, Mr. Jacobsen. I wanted to call on Mr. Kayser because he has been very quiet here, and he represents gas.

Mr. JACOBSEN. Mr. Taggart started out by saying if the figures regarding oil reserves are to be relied upon for 14 or 15 years, whatever it is, if the figures for gas of 28 years are to be relied upon, then—and there followed the rest of his statement.

Now, the fact is that those figures are to be relied upon for what they are, namely, an estimate of the actually definitely proved reserves. They are not in any way by any stretch of imagination a measure of the amount of oil that we expect to have down the road.

I would like to come back again to the fact that in 1922 the United States Geological Survey estimated that we had 10 years of reserves. We did not have 14 or 15 years, we had slightly less than 10, because the estimate of oil reserves was 5,000,000,000 barrels and the production in 1922 was 5,057,000,000. In other words, then we had less than 10 years, or 9 years proved reserves. They were estimated in the same way as proved reserves are now estimated.

Now 29 years later we have approximately 30 billion, and in the meantime we have produced and used up approximately 35 billion, although we had only 5 billion barrels according to this estimate in 1922.

Therefore, I want to stress that these reserve figures for oil and gas are to be relied upon. They are the best figures that can be gotten up, but they are only to be relied upon for what they are, and what they are represented to be, namely, estimates of actual definitely proved reserves as of midnight December 31, 1950, and they are not in any way a measure of the amount of oil that we expect to be able to produce down the road.

Senator LONG. Do you have any idea at all, or do the geologists have any thinking on the subject of how much oil we might ultimately find in this country?

Mr. JACOBSEN. Some guesses have been made. Mr. McCollum is probably better informed on that than I am. I think a total of 100 billion or something like that.

Mr. McCollum. About 120 billion, and the thinking today of the mass of geologists referred to by Mr. Ball here is that those figures are very conservative.

I would like to supplement what Mr. Jacobsen said here as to figures. In 1900 the production of this country was less than 70 million barrels a year. Then, we had a reserve of only a few billion barrels. The demand increased. In 1930 we produced almost a thousand million barrels and reserves increased to almost 14 billion barrels. Reserves increased a step or two ahead of the demand.

This last year there was produced about 2 billion barrels and we have increased reserves to almost double the 1930 figure. At the same time we have an excess producing capacity estimated at 20 percent.

We create a reserve above what is needed for demand. When the demand goes up, you have to go out and create additional reserves. Your reserve goes up one step ahead of demand.

These figures are probably confusing to you gentlemen of the coal industry because they are blocked-out reserves and are related to a producing capacity over and above that which is needed to meet the demand rather than the total remaining undiscovered or undeveloped reserves of the United States.

The Chairman. Let me ask this question. Do you wish the committee to understand that the present estimate of 30 billion barrels reserve is a minimum which can be relied upon by the public and the United States, that the oil presently exists, is known to exist and can be produced whether you discover an additional barrel of oil or not?

Mr. Wilson. Exactly.

Mr. McCollum. Yes.

Mr. Jacobsen. If you call it a minimum, Senator, you do not go far enough because you know that it is less than a minimum.

The Chairman. That is what I understood you meant, and I wanted to get it clear on the record.

Mr. Jacobsen. The figure is already wrong.

Mr. Holman. It is not reliable, in other words, Senator.

The Chairman. It is not reliable on the high side, but you contend that it is reliable on the low side.

Mr. Wilson. Right.

Mr. McCollum. When the demand goes up and incentive is there to supply it, the reserve will go up. The total remaining resources which we refer to as the reserve is unknown. You referred to 120 billion barrels. Nobody knows. It will be limited only by man's ingenuity and by economics.

Mr. Taggart. Does anybody know where they are, the 120 billion?

Mr. McCollum. I would like Mr. Ball to comment on where they might be.

Mr. Jacobsen. I wish somebody knew where they were. We would save an awful lot of dry holes if we did know.

Mr. Taggart. The only one I ever had any personal investment in did not have anything in it.

Mr. Potter. Mr. Chairman, there is still one point with respect to the reserves. I understand perfectly well what they are saying about reserves, but if that is true why the gigantic foreign developments? If everything they say is true, why have they had to go abroad and make very expensive, very big developments?

Cannot the companies in this country find those resources here if that is so and produce them, or is it purely a matter of economics that it can be brought back to this country a lot cheaper?

Mr. WILSON. The reason they go abroad is, may I suggest, they think they can make a profit if they do so.

Mr. HOLMAN. Certainly the reason that our company has gone abroad is because we have a lot of consumers abroad, and doing business abroad, the logistics of getting liquid fuel to the consumer in some places, certainly makes foreign reserves more desirable, we think, than domestic reserves for those particular markets.

The CHAIRMAN. One conclusion, Mr. Holman, which I derive from the petroleum hearings held several years ago was this: If the consumption of petroleum and petroleum products by the inhabitants of other countries could be built up to anything comparing to the rate of consumption in the United States, then in all probability all of the foreign-produced petroleum would be used abroad and we probably would have to draw to a much greater extent than we are now drawing upon the coal reserves in the United States to supplement the demands of the people of the United States.

Mr. POTTER. Mr. Chairman, is it not just a little bit funny that we have to export coal to Europe today and right after the war at a great economic disadvantage to this country, when there is oil being imported from the same sources?

The CHAIRMAN. If you are asking that question of me, I would say that it was due to the turbulent condition in which the world found itself. Production in the coal mines of the Ruhr had not been restored to anything like the prewar rate of production. Now that production is being restored there, the exportation from the United States has been rapidly falling off.

Mr. POTTER. But the Ruhr never exported to Great Britain.

Mr. BATTLE. We are sending coal to England now.

The CHAIRMAN. If the English could adopt our techniques of mining, perhaps they would not import, but they do not do that, you see.

Mr. WILSON. Nationalized industry may be one reason also.

Senator LONG. Isn't England attempting now to modernize her coal mines in order that she can get more production out of them?

Mr. POTTER. They are attempting to regain the prewar production. They are attempting that, sir, but I still do not find from the oil industry a definite reason. Is it economics, sir, for the development of the foreign oil reserves or is it because there are not reserves in this country? Would you say it is strictly economic?

Mr. HOLMAN. That is certainly the reason we have done it, to try to make a profit.

Mr. POTTER. That is what I am trying to get.

Mr. HOLMAN. But I think the location of reserves in relation to markets is one thing that is material in both our domestic and our foreign operations.

The CHAIRMAN. Perhaps I might put Dr. Potter's question a little bit more bluntly. Are we producing oil abroad for the purpose of importing it into the United States market?

Mr. HOLMAN. Yes; we import some into the United States.

The CHAIRMAN. You said some. I left the word "some" out deliberately. Is it in order to supplement domestic supplies to meet the demand in the United States, or is it to meet demand elsewhere?

Mr. HOLMAN. We are importing into and exporting from the United States, but in general over the years we have supplemented our domestic production with some imports, and it has varied a good deal according to the times.

The CHAIRMAN. Let me put it this way. Are you operating abroad for the United States market or for the world market?

Mr. HOLMAN. For the world market, including the United States.

The CHAIRMAN. Surely.

Mr. HOLMAN. As you know, Senator, a lot of hearings on imports have been going on for quite a while, and the final report by the Select Committee on Small Business, which was just issued recently, has a great deal of information pertaining to the subject we have been discussing this morning. I would suggest for the benefit of the committee that they consider that.

Senator LONG. Do you agree with that report?

Mr. HOLMAN. I would call your attention to one clause in it:

> We are fortunate that too hasty restrictions on imports have not precluded their availability.

The CHAIRMAN. All of these hearings and reports, of course, are available to the committee. Mr. Kayser wanted to make a comment.

Mr. KAYSER. I would like to say one thing in connection with the statement in respect to the expansion of the natural-gas business, and in answer to the question of whether or not a policy should be established which would have to be implemented in some manner by telling people what they could and could not use. It would not be effective unless something of that nature was done.

Now, obviously, that should not be done unless there is a real demand that cannot be met otherwise.

Now as far as I am concerned in my operations in the natural-gas business, I do not say it is going to last forever. How long it is going to last, I try to look down the road as far as I can and appraise all of the situation, because we are putting a lot of other people's money into the transmission lines that have their sole means of making revenue from the transportation of gas.

Now these figures here are comforting to me in that respect, and they are simply a recitation in round figures in billion of reserves.

Mr. WILSON. Trillions.

Mr. KAYSER. They are in trillions. Now in the first place, the last 5 years, as everyone at this table knows, has been the period of the greatest utilization of natural gas. It has been the period of the greatest expansion of the natural-gas business, and I am perfectly willing to say, and I think all will agree,that one of the most phenomenal expansions in the past 5 years has been the natural-gas business.

The CHAIRMAN. The natural-gas business is not the only business that has expanded in the last 5 years.

Mr. KAYSER. It is not, but it has been one of the most phenomenal and probably the greatest percentagewise, not the greatest but one of the greatest percentagewise.

The proved reserves in 1945 were 147 trillion; in 1946, 160 trillion; in 1947, 165 trillion; in 1948, 173 trillion; in 1949, 180 trillion; in 1950, just out, 185 trillion—an increase of 38 trillion over the 6-year period.

Mr. BATTLE. May I ask whose figures those are?

Mr. KAYSER. Those are the figures of the American Gas Association, and I have some substantial connection with how those figures are put together.

Mr. BATTLE. They are not Government figures?

Mr. KAYSER. They are not, but they are put together in the most reliable manner and with the least idea of puffing anything at all.

We know how they are picked up and where they are picked up, and I am perfectly willing to say that the figures are reliable—I do not care who feels the other way about it—personally I do not want any bad figures in respect to reserves. I want the figures that are based upon genuine facts that I can rely upon, because every day we are busy with that same thing, getting people to put more money into transportation lines relying upon reserves.

I know how these reserves were calculated in the very area in which we operate, so that they are reliable reserves and are conservative, as a matter of fact to my knowledge, in the area in which I operate.

Mr. BATTLE. May I suggest, Mr. Chairman, this is a committee of Congress and it is eventually going to make some kind of report. I ask you do you think that the public will be more impressed with figures that are gathered by the industry or gathered and confirmed by the Government itself?

Mr. KAYSER. I think that the public will be impressed with both. The figures have been gathered by public agencies, and to the extent that these figures are checked against further verification, that will be just that much better. I am quite sure that anything that comes out of this committee will be impressive to the public.

(Discussion off the record.)

The CHAIRMAN. You may proceed, Mr. Kayser.

Mr. KAYSER. Whatever figures this committee puts out will be impressive, and we are quite sure will add to a clarification of the public's view.

I want to say one thing further in respect to the reserves. That in respect to natural gas—I am not going to read these figures—the increase of reserves by discovery is practically double the consumption, that is, the total reserves have increased each year by almost double the amount of the consumption during that year.

The CHAIRMAN. Mr. Kayser, may I not ask is it not a fact that the Bureau of Mines has cooperated to some extent in the preparation of those figures?

Mr. KAYSER. Yes, sir; I am quite sure that is true. The Bureau of Mines and the American Gas Association have cooperated in all of these compilations. One of the members of the reserve committee is from the Bureau of Mines.

The CHAIRMAN. That was my understanding.

Mr. KAYSER. There is one other point I want to make that is of importance to me. Criticism has been leveled at the natural-gas business as having moved in and dislocated the economy by substituting a vanishing and exhaustible fuel in the place of one that had a very much greater life, namely, coal. A reading of these basic facts makes it perfectly clear just what one of the gentlemen said, that the economy has changed over to a mobile economy.

It is now relying, and more and more as this record shows indisputably, upon liquid and gaseous fuel. That is what we are running on, that is what we have been running on.

Now, according to this report in 1850 the principal energy resource was chopped wood. Now, that is just 50 years prior to the time this report starts. That was just 50 years up to that time.

Then, 1900 down to this date, look at the trend. The trend is definitely, unconditionally toward liquid and gaseous fuels.

Now, the natural-gas industry and the petroleum industry—but I am speaking now for the natural-gas industry—has performed a real service to the economy in that it has and is now constructing a transportation system Nation-wide that is adapted to the distribution of this kind of fuel toward which the trend is moving us.

I had to make a talk on the Pacific coast on the significance of the natural-gas expansion, and I had the best engineers in the United States compile for me chart after chart showing the relative efficiency of the various methods of transportation of energy, and here is the result of that chart.

The most inefficient method of transportation of a unit of energy is the transportation of coal by railroad. The next most inefficient method is the transportation of 435 B. t. u. gas by pipeline. The next most inefficient but coming on toward the efficient, and moving a substantial distance over on the chart, is the transportation of a thousand B. t. u. natural gas through high-pressure, large-diameter pipelines, and the next on the chart is the transportation of oil by pipeline, so that from the standpoint of the development of technology in transportation, the transportation—I do not like to say this, but I am saying it—of energy by oil pipeline is the most efficient method to get a unit of energy to a given spot, electric lines not excepted.

Mr. POTTER. What is your measure of efficiency?

Mr. KAYSER. A kilowatt-hour.

Mr. POTTER. Measured in cents, dollars, or in terms of energy required, or what?

Mr. KAYSER. It has to be measured in dollars for purposes of comparison.

Mr. POTTER. I would like to answer that as soon as he finishes.

Mr. KAYSER. You would not have any other basis for the measurement of it except from the standpoint of its efficiency.

Senator LONG. When coal takes to water, though, you have a different proposition, do you not?

Mr. KAYSER. Yes, certainly; and you would have a different proposition, too, with a tanker of oil. The only spots where you can move coal by water are obviously limited. You cannot get complete distribution by water.

Mr. POTTER. As long as the industry continues to subsidize the railroad for passenger traffic and less than carload, that is true. That is extremely important and this committee cannot lose sight of that. The point was raised, Do you want to destroy your basic transportation system?

Mr. KAYSER. Please wait until I get through.

Mr. POTTER. I will be glad to wait.

Mr. KAYSER. I am simply taking the freight rates as they exist, had them set up, and used that as the basis of the cost of transportation, and changed each unit into a kilowatt-hour because that is the accepted measure of energy.

Now, the point is this: That the natural-gas pipelines have constructed a system of transportation by high-pressure, large-diameter

pipelines that is next to the most efficient method of moving a unit of energy. Those lines criss-cross the country in its entire extent, and every one of them, as we had set in red on a map, made by the Interior Department, criss-cross the great coal reserves or approach close to the great shale reserves of the United States, so that when the present gas reserves are exhausted, if that time ever comes, these lines can be connected to synthetic plants at the mouth of the mines and can transport high B. t. u. gas to the same markets that are now using natural gas.

From a long-range point of view it seems to me so clear that the present fuel policy that has been in effect for 50 years, that has produced the highest standard of living that the world has seen should be continued and encouraged with a view that when and if these reserves of natural gas and these reserves of petroleum turn over that hill where the rate of discovery is not sufficient to meet the increased demand, we will be able to convert all of these other sources of energy into the form of energy that the country has developed to use, namely, the liquid and the gases and transport them to market by these same pipelines. That not only applies to gas but to oil as well. The transportation system will be there.

The CHAIRMAN. Do you wish to have your logic take you so far as to say that since oil may be transported more efficiently than any other fuel, that oil should be used first before any of the others should be used?

Mr. KAYSER. Not at all. Your balance of use, unless we are going to a completely socialistic economy, is going to be based upon public demand, balanced by the price, as supply changes the price structure. Therefore, there will come a place in the cost where the public will slack off on its demand for natural gas, unquestionably, and the only point I am making is that it is not necessary and not in the interest of the public to forcibly shut off the development of either the natural gas or the oil industry.

The CHAIRMAN. Then your point is that all of these competing fuels should continue to compete for the expanding market?

Mr. KAYSER. Certainly.

Mr. WILSON. Right.

Mr. KAYSER. I am in favor just as strong as I can be in the development of synthetic methods of making gas. I want to see 1,000 B. t. u. gas—900, because I think 1,000 is a little too difficult. We have gone into it some and we expect and are willing to spend money. we are willing to join people in the experimental plants to make 900 B. t. u. gas out of coal, out of oil shale, out of lignite.

The CHAIRMAN. Does that mean that you recognize that this growing trend toward an ever greater and greater demand for energy should lead us to provide a supplementary supply, say, of gaseous or liquid fuel to add to that which is now capable of production by natural gas or by petroleum? In other words, you think that coal and oil shale should be used to produce synthetic liquid fuels and gas should be used to produce liquid fuel to meet this growing demand?

Mr. KAYSER. It takes a long time to develop the technology of making those synthetic fuels successfully. We have seen it at Brownsville, the plant that is supposed to be making all of the products out of natural gas. They have lots of difficulties and it takes time to iron them out.

What we should do is to develop that technology. I say that there is no reason under the sun for a supplementary supply as long as these reserve figures are going up as they are going up. It does not make sense to supplement that supply in the face of those figures.

If the time comes when the reserve figures do go down, then we should be ready with a technology that makes possible the making of these products out of these sources of synthetic fuels.

The CHAIRMAN. If it should be the aim to make the United States self-sufficient so far as energy is concerned, then would it follow in your opinion that this supplementary supply should be developed?

Mr. KAYSER. I would not want to say that. I think it is sufficient as it runs now, and it will always be sufficient as long as this trend of figures that I have just read exists. When it ceases to be, why, that is another story.

Mr. WILSON. It depends on what you mean by "develop." If you mean get the technology worked out, by all means, yes, but if you mean to build plants long before they are economical or long before the processes are perfected, I think the answer is "No," not until this curve turns down.

Mr. KAYSER. The answer is certainly "No." There is no point in spending that money displacing sources of supply and retarding the development that is going on.

The CHAIRMAN. Let me put the question against this background, and I will address it to you, Dr. Wilson, also. We are told by reputable leaders that the situation in the world now is such that the people of the United States must be prepared for a period which is variously estimated from 5 to 15 years to prepare militarily for defense.

That of course means, since war and industry use the same technologies and the same fuels, that we must be prepared to make certain that this country shall not during that period be in danger of losing its supply of energy sources. In those circumstances should we contemplate the encouragement of a supplementary supply?

Mr. WILSON. If you mean by "encouragement" doing research, by all means we should and are. If you mean building plants prematurely before this discovery curve turns down, taking steel, manpower, mining labor, and other things that are desperately needed in time of emergency and diverting them to that, no. If 10 years from now we should find this discovery rate was slowing up, maybe we should then.

The CHAIRMAN. Now to make it specific: You do not believe, do you, that the work which is being done by the Bureau of Mines with respect to making synthetic fuel from shale and from coal is not a very valuable contribution to our over-all economy?

Mr. WILSON. I agree that it is. I said "research and development work," yes, but not building commercial plants of which there has been some discussion, at this time. Research and development is fine and should continue.

The CHAIRMAN. Of course, to build commercial plants before you can manufacture the supplementary supply on a cost basis which would put it in competition with these others, would be a waste of money.

Mr. WILSON. That is right.

The CHAIRMAN. Of labor and of material. There is no question about that.

Mr. WILSON. That is right.

The CHAIRMAN. Now, Dr. Potter.

Mr. POTTER. I should like to follow that transportation point just a moment, sir. The efficiency of transportation can be measured the way that Mr. Kayser points out, but if it is the policy of the United States that our competing fuels, that is, oil and gas, do not have to pay the proportionate share of loss in revenue of the railroads that it is geared to, that coal must make up the major deficits of the railroad transportation charges, we can agree to go along with the proposition of the oil and gas industry if the Congress of the United States will treat us exactly the same way that other industries are treated with respect to taxes and with respect to transportation, and I am quite sure we could furnish all the energy requirements that are necessary.

Now if he wants to measure transportation in terms of cost, cents per ton which I asked, it will be noted that the railroads lost $500,000,000 out of pocket before capital charges last year on passenger traffic, and coal was one of their biggest sources of revenue. If you want to destroy the transportation system of the United States, go ahead and do it.

The CHAIRMAN. It is now 1 o'clock. Mr. Cooke has not had an opportunity to make any comment. Would you care to add a few words at this point?

Mr. COOKE. I could add a few words.

The CHAIRMAN. Or would you like to postpone it until the next session?

Mr. COOKE. I will take the next session and take a little longer, if I may.

The CHAIRMAN. Very good. Mr. Bloch may do the same thing.

(Discussion off the record.)

The CHAIRMAN. The committee will stand in recess until 10 o'clock tomorrow morning in this room.

(Whereupon, at 1 p. m., the committee adjourned, to reconvene on Thursday, March 8, 1951, at 10 a. m.)

NATIONAL FUEL RESERVES AND FUEL POLICY

THURSDAY, MARCH 8, 1951

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The committee met, pursuant to adjournment, at 10:05 a. m., in the caucus room, Senate Office Building, Senator O'Mahoney (chairman) presiding.

Present: Senators Joseph C. O'Mahoney (Wyoming), Clinton P. Anderson (New Mexico), and Russell B. Long (Louisiana).

Also present: Max W. Ball, oil and gas consultant, 1025 Vermont Avenue NW., Washington, D. C.; John Battle, president, National Coal Association, Washington, D. C.; Ivan Bloch, consulting engineer, Portland, Oreg.; William H. Cooke, chairman, Coal Defense Committee and president, Little Sister Coal Corp., Chicago, Ill.; Frank Earnest, president, Anthracite Institute, Wilkes-Barre, Pa.; Harold B. Fell, executive vice president, IPAA Ardmore, Okla.; J. Ed Warren, president, Independent Petroleum Association of America; Eugene Holman, president, Standard Oil Co. (New Jersey), New York, N. Y.; A. Jacobsen, chairman, National Oil Policy Committee, API, president, Amerada Petroleum Corp., New York, N. Y.; Paul Kayser, president, Independent Natural Gas Association, and president, El Paso Natural Gas Co., Houston, Tex.; L. F. McCollum, president, Continental Oil Co., Houston, Tex.; C. J. Potter, president, Rochester & Pittsburgh Coal Co., Indiana, Pa.; Ralph E. Taggart, president, Philadelphia & Reading Coal & Iron Co., Philadelphia, Pa.; Dr. Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana), Chicago, Ill.; Robert E. Lee Hall, counsel for the National Coal Association; Rear Adm. Burton B. Biggs, chairman of Petroleum Committee of Munitions Board; Russell B. Brown, general counsel, IPAA; and Arthur A. Sandusky, committee staff counsel.

The CHAIRMAN. The committee will come to order, please.

At the beginning of the session yesterday I announced that Mr. Warwick M. Downing of Denver was unable to be present by reason of his illness. He was extremely interested in the problem and had written me several letters. Indeed, while he was in the hospital with a high fever he wrote a statement to be incorporated in the record, he was so interested in it.

I will say to the committee and to the members of the panel that it was a very highly interesting statement. Mr. Downing, one of the best known lawyers of the West and a member of the Interstate Oil Compact Commission for many years, is well qualified to comment on matters of this kind. However, this morning he has sent word to me that he would like to withdraw the statement. He is now out of the hospital and back in his office, and he is revising the statement which he

wrote in the hospital. I am sure that either one of these statements would be of great value to everybody concerned in this study, but, of course, instead of presenting his statement for the record at this time I shall withhold it. I wanted to make this reference to the contribution he stands ready to make and to express great regret that he was not here to participate in the round-table discussion, because I think he could ask many questions that would be highly illuminating to the members of the panel as well as to the members of the committee.

(NOTE.—Mr. Downing's revised statement was received in time for insertion at this point in the printed record.)

STATEMENT OF WARWICK M. DOWNING

My name is Warwick M. Downing. I am a lawyer, interested in oil. I am very strongly an independent, and greatly interested in the development of our fuel reserves, particularly petroleum.

This is in reality the energy utilization age. Constantly increasing amounts of energy have been the factor that has caused our enormous progress. This has not only been responsible for the winning of two wars, but it is necessary to continue the improvement in our way of life—not only our necessities, but our pleasures. During World War II, over 60 percent of all tonnage shipped overseas consisted of petroleum products. I have no set plan, but do welcome the opportunity to suggest certain considerations to help in evaluating our future.

1. The Federal Government should adopt as its first, essential, an all-embracing policy—to heed the great lesson of the past, that what we have accomplished has been without Government conrols and restrictions, but in the exercise of free enterprise. There is no occasion to experiment. Any experimental change would be dangerous.

2. We have been blessed with fuel resources that will satisfy our needs for years, and maybe for centuries. All that is necessary is to allow American ingenuity to develop and utilize such resources. Ten years ago the American Association of Petroleum Geologists published a booklet, Possible Future Oil Provinces of the United States and Canada. The interesting part of this booklet is the map, showing that between one-third and one-half of the area of the United States has the possibility of producing petroleum. An interesting feature is that the map includes as possibly oil-bearing, the Calgary area in Canada, then considered barren, but which has opened up several billion barrels of newly discovered oil. We have every reason to believe that new discoveries will continue to meet future increasing demand. Likewise, we have in reserve, or in prospect, abundant supplies of natural gas. Proven deposits of oil shale and coal insure an adequate supply of synthetic liquid fuel for at least a century, and perhaps for many centuries.

One of the greatest undertakings by our Government, in some respects the very greatest, has been the work accomplished under the so-called Synthetic Fuels Act. This law was not the result of any public demand, but this law was passed solely through the initiative of the great Senator who heads this committee, certainly a far-sighted statesmanlike effort almost unparalleled in our history. The law was frowned upon, and even derided, by many of the leaders of the oil industry. Yet, as the result of this law the Government has solved for the industry, at least in a preliminary way, great scientific and business problems, so that we know that synthetic liquid fuels may be obtained from oil shale and coal in almost unlimited quantities, and at a cost not appreciably greater at the moment than the cost of comparable grades of petroleum.

We also know from the Bureau of Mines that the investment cost of producing 12,000 barrels per day of shale oil may be reduced to an amount less than the cost of developing an equal amount of petroleum. We also know that a well-laid-out network of pipelines, not greater than 20,000 miles, could carry Colorado shale oil to every corner of the Nation, and no doubt existing lines could largely be used. It must also be remembered that in developing our oil shale and coal the so-called finding cost is eliminated. This magnificent job by the Government is the direct result of the energy and ability of Secretary Chapman, and is an example of what the Government may do to help industry, and is in sharp contrast to the constant effort of so many Government officials, so-called planners, to do things which thwart and prevent industrial growth.

3. The human element is of special importance. The independent wildcatter is sui generis. He has been responsible for 80 percent of all our petroleum discoveries. Upon him we must depend for our future petroleum supply. This group, from company executive down to roustabout, is of the same type that has made our country great—the pioneers, men and women who are willing to work long and hard, who are thrifty, ambitious to get ahead and provide their own security, daring and willing to take a chance, persevering with greater energy after each failure, and who look to Uncle Sam, not for hand-outs, but only for a square deal. These are "he-men" who will not be pushed around by any Federal agent. Give them a free hand, and they will accomplish everything expected of them, and more. But try to regiment them, or try to impose rigid governmental controls, and you will destroy the most important element of the oil industry. I will not say that this group is the best and highest type of American citizenship, but I do say emphatically that there are none better.

4. The economic law the law of supply and demand, must be permitted to govern the price of petroleum and its products. Undoubtedly the need for new petroleum discoveries in this country will bring about higher prices, in time much higher prices. One of the most essential elements in maintaining productive capacity is a price adequate to cover the cost of finding and developing needed reserves. An able statistician reports the average profit of oil investment is only 8.7 percent, but this bookkeeping profit has been largely caused by using as a base the cost of oil put in reserve years ago at a very low cost, instead of estimating profits as they should be on a replacement cost. A much higher profit rate is really necessary because the oil industry is the only large industry that must provide from its profits for expansion. Other industries may borrow the money necessary for new building, plants, equipment or supplies. But no one will loan money and depend for repayment upon the success of a wildcat well. In fact, 57 percent of the profits of the industry are plowed back into the business. Capital expenditures of all the companies are four times greater than the dividends. A fair price is necessary, not only to encourage speculative drilling or wildcatting, but to finance the same.

The cost of finding new oil, not greater than 25 cents a barrel a few years ago, is at least $1.50 per barrel today. Wildcat wells are much deeper, the cost per foot increases almost in geometric ratio as greater depth is obtained, and the cost of supplies and labor has, of course, increased at a rapid rate. The greatest factor in finding cost increase, however, is the increasing difficulty of finding new oil fields. The American Association of Petroleum Geologists has published a bulletin entitled, "Degrees of Success in Wildcat Drilling." The article deals with wildcat wells, commonly known as "new field" wildcats, and not with so-called wildcat wells which are necessary in the developing and the finding boundaries of new fields. The percentages are the figures obtained from 8,696 wells, which gave somewhat better results than the average. The result shows that only one well out of every 44 new field wildcats discovered a new field with more than a million barrels of total ultimate recoverable oil; that only one well out of every 243 new field wildcats discovered a field with more than 10 million barrels of total ultimate recovery, and only one well out of every 967 new field wildcats discovered a major pool, that is, a field with more than 50 million barrels of total ultimate recoverable oil.

As all must realize, a million-barrel field, particularly at great depth, does not do much more than pay its cost; the 10 million-barrel field is only a fair reward for the discovery expense, and the plums, the major fields, are exceedingly scarce.

Experience has shown us that there is a direct relationship between price, footage of wells drilled, and discovery of new oil reserves. When the price is low, the discovery rate is at bottom, whereas when the price is increased, the discovery rate increases to the same extent.

During World War II, years 1941–45, the efficient crude oil capacity declined from 4,756,000 barrels a day in 1941, to 4,579,000 barrels daily in 1945 which was a rate so high as to produce damage to some oil fields. During that period new wells declined by nearly half. All this was due to a price for crude fixed by a Federal agent which was entirely too low. As a matter of fact, the price index of crude today is only 136 compared with the parity of 100, whereas the price index of all commodities is 183. Furthermore, the quality of gasoline in particular has very greatly improved during the last 20 years, so that 1 gallon of gas will do the work of 1½ to 2 gallons of an older vintage.

5. It would be first-degree murder to lessen the depletion allowance, established nearly a quarter of a century ago after thorough study. This depletion allow-

ance is not only just, because it doesn't represent income at all, but compensates only for return or exhaustion of capital, but perhaps of greater importance because this depletion allowance is necessary to finance essential exploratory work.

6. The American industry must be protected against any flood of cheap foreign oil. The cost of Texas oil laid down on the eastern seaboard is about $1 per barrel above the cost of Arabian crude. Middle eastern wells are comparatively shallow, and are flowing wells, flowing as much as 10,000 barrels per day per well. In America the average well produces about 12 barrels per day, involving a much higher cost of production. Unrestricted foreign imports can destroy the American oil industry—certainly the producing and exploratory operations. And to what purpose? To enable the British to seize the American gasoline market, the richest commercial prize in the world, and later when the American industry is destroyed by cheap prices, to make us pay through the nose? To show how smart are the British, since the end of World War II we have given them 6 billion dollars because of their poverty: yet the British have owned 46 percent of the middle eastern oil, worth today perhaps 30 or 40 billion dollars, and in some strange fashion have persuaded our State Department to never even suggest that the British transfer to us a part of this foreign oil in payment of their debts and the further money they need. Clearly we must not put any dependence upon foreign oil. In case of war, not a single barrel would come to our shores after war was declared. In the absence of war, the Middle Eastern princes have had a taste of blood, and their rapacity will have no bounds. They will demand more and more money, or else. Under international law a few Arab nations may nationalize the entire middle eastern industry and pay for it whenever they choose, probably never. We have a subtle enemy that will see to it that foreign oil will fail us when needed.

7. If we use synthetic liquid fuels to supplement petroleum we may double our supply of gasoline and lubricants, and have available for many, many years to come, sufficient gasoline and lubricants for all foreseeable demands, including an abnormal demand caused by war.

At present 42 percent of a barrel of oil is made into gasoline. Based upon our annual production of almost 2 billion barrels of petroleum, this means a product of 840 million barrels of gasoline; distillate fuels take about 21 percent of the petroleum barrel, and residual fuels 22 percent, a total of 420 million barrels for distillate fuel and 440 million barrels for residual fuel. Lube stocks, kerosene, coke, asphalt, and other products, as well as waste, account for the balance. It is scientifically possible by "cracking" to convert 85 percent of the Diesel and residual fuels, 860 million barrels, into gasoline. This would mean that our present crude petroleum supply, when economic conditions permit, could produce an additional 731 millions of barrels of gasoline and lubricants.

Turning to gas, our yearly production is more than 7 trillion cubic feet. Excluding gas used in repressuring, fuel use, refining use, carbon black, and gas sold for domestic use, that is, for homes, we find that 2,105,000,000 thousand cubic feet are devoted to commercial and industrial use. If this be processed into gasoline, as it becomes economically feasible to do so, millions of additional barrels per year will be made available.

These steps of increasing the supply of petroleum products will come about in a natural manner under our free enterprise system when the necessity arises.

8. Obviously, natural law and the industry will find the way to supplement our petroleum supply with synthetic liquid fuel. At present petroleum is carrying a heavy portion of the Nation's fuel requirements. Synthetic liquid fuels can be and should be ready to carry a part of the demand for fuel, gradually increasing in case there is necessity therefor. Let me emphasize that in any suggested change in the order of the use of our energy, resources must be sought under our free enterprise system through a full play of competition. A forced adoption of such a plan would disrupt and retard the fullest development of our resources.

Obviously, water power should be developed and made use of wherever possible because its use does not exhaust our mineral resources.

Next in order should be oil shale, which is valuable chiefly and perhaps solely for the production of liquid fuel.

Next in order should be coal, of which there is a tremendous supply. However, coal has many valuable constituents not being made use of.

Our next fuel resource to be considered is petroleum, especially suited for the manufacture of gasoline and lubricants.

The most precious of our resources, and the one to be used most sparingly and not wasted, is natural gas. This commodity has a marvelous value—for chemicals, for making rubber, for light, for conversion into gasoline, and indeed for almost an endless variety of valuable products.

I am not speaking for the present, but if and when there should be any shortage of any fuel supply, we have at hand a simple remedy—decrease the refining of residual and Diesel fuels from petroleum, and supplant the same by greater use of synthetic liquid fuels; make greater use of our water power, our coal and oil shale resources, in order to help carry the load.

9. How may a better use of our liquid fuel supplies be brought about? The only way it could possibly be done would be by natural economic law, that is, through competitive price. If and when demand for gasoline is overtaking supply, the price of gasoline would naturally rise, unless costs can be reduced. There could not be any serious increase in such price because synthetic liquid fuel would be available. In fact, there is reason to believe that when circumstances require the industry to tackle the problem of synthetic liquid fuel, the price will be less than the present price of comparable petroleum products.

We must necessarily face an increase in the price of gasoline. There is no reason why the price of gasoline should not increase in accordance with the increase in price of all other commodities. In fact, there is every reason that the price of gasoline should increase to a higher than average level. The refinery price of gasoline is only 10½ cents a gallon. There is no other commodity where so little money will buy so much. If the present price seems high, it is because the Federal and State Governments each take a big tax bite out of the consumer. It will be better for the general welfare and security of our Nation if these Governments raised their tax money elsewhere. Certainly the consumer would not seriously object to an increase in price if necessary to maintain our present adequate supply. It is better to pay a little more for our gasoline and have it when we want it, than to pay a less price temporarily and then go without. If we allow economic laws to function we will have petroleum being utilized for its most valuable constituents.

It must be constantly kept in mind that our aim is not to save a penny or two in the price of gasoline, but to so act that we may have an adequate supply of liquid fuels for a long, long time to come, sufficient for war and peace, and all within continental United States.

Without an adequate supply of liquid fuels we make ourselves defenseless in case of war. Nothing could more certainly bring about war, and an attack by an aggressor, than for us to allow our fuel supply to become inadequate. It would be criminal folly for us to become dependent for one second upon foreign oil. By utilizing our own fuel resources, not only may we insure an adequate supply in time of war or peace, but a fair and reasonable price to the consumer.

The CHAIRMAN. Members of the panel will recall that we sent to each person who was invited to attend a list of suggested questions which seemed to be pertinent to a fuel study. You are all aware of them.

I might briefly mention some of the subjects that were suggested: The nature and extent of our reserves of all these various fuels; the cost of exploration and production of each of the fuels, because, of course, cost is one of the primary factors in the delivery of the fuel for consumption by industry and by the householder.

Particular reference perhaps should be made to the problem of steel. Do we have steel supplies, for example, in petroleum and the gas industry sufficient to provide the pipelines that are necessary to distribute the fuels?

Senator LONG. Also for the wells, Mr. Chairman.

The CHAIRMAN. And for the wells. I was about to add that, of course. As a matter of fact, already the National Production Authority has found it necessary to make a special allocation of steel pipe for drilling. The independent producer was finding a great deal of difficulty——

Senator LONG. And still is.

The CHAIRMAN (continuing). In getting pipe for his purposes, in competition with the more powerful companies. The Munitions Board statement which I read into the record yesterday suggests whether in an all-out defense economy, and in preparation for such an

economy, there would be any desirability in stockpiling fuels—the problem of stripper wells, and production of marginal resources; and that also raises the question of marginal mines.

In addition to that, we have the problem of coking coal. Do we have enough coking coal in the United States, and what are the substitutes for it?

These suggestions I make only to remind the members of the panel of what has already been laid before them and of the things they have undoubtedly thought of themselves.

Now, we shall begin this morning with Mr. Cooke and with Mr. Bloch, who did not have an opportunity to speak yesterday. I think I want to say to the members of the committee who had to leave before we concluded yesterday that the longer the session lasted, the more interesting it became. If Senator Anderson, to whom I shall have to turn over the chairmanship before 10:30 because of the demand of another committee—the Committee on Defense Appropriations—if he will keep this session running I feel sure it will get fast and furious before the day is out.

I am advised that Mr. Fell, who was on our list and was unable to be present yesterday, is here. Mr. Harold B. Fell, executive vice president of the Independent Petroleum Association.

Mr. FELL. Mr. Warren is taking my place.

The CHAIRMAN. Well, come forward. I can recognize you from the distance, Mr. Fell. We are always glad to have you here.

Mr. JACOBSEN. Mr. Chairman, I wonder if you would pardon me in view of the fact that you said you would have to leave by 10:30. There is one short thing that I would like to bring forward and which, if possible, I would like to mention while you are here, if I may.

The CHAIRMAN. That will be agreeable, I am sure, to Mr. Cooke.

Mr. JACOBSEN. It will not take more than 5 or 10 minutes, at the most.

I realize, of course, that a fuel policy takes in a good deal more territory than just an oil policy, but the oil part of the general fuel situation is certainly very important; and, with regard to a policy for the oil industry I would like to call the attention of the gentlemen here present to the fact that 3 or 4 years ago a special committee of the Senate headed by Senator O'Mahoney conducted a very thoroughgoing, competent, exceedingly complete, effective and objective study of the oil industry in all its branches—domestic, foreign, big company and little company, production, pipeline, marketing, and everything you could think of.

The CHAIRMAN. Mr. Jacobsen, I always like to hear you talk.

Mr. JACOBSEN. The hearings lasted, with interruptions, about a year. I think there were 125 or 150 witnesses. As a result of those hearings the committee, headed by you, brought forth a recommendation for a national oil policy. I would like with your permission to introduce that as a part of the record of this meeting. It is a policy which, not only in my opinion but in the opinion of everybody in the oil industry with whom I have discussed it, could not be improved upon at the time it was recommended, and it is just a good today as it was at the time when you suggested it. It is quite short and to the point.

The CHAIRMAN. I am very happy to have you put it in the record.

Mr. JACOBSEN. May I read it? It is quite short.

The CHAIRMAN. Yes, indeed.

Mr. JACOBSEN. There is a preamble which is very short, and then it says:

To these ends we should—

1. Enact those laws which are most conducive to stimulating additional exploration and development in the United States. Encourage conservation to prevent waste. Promote interstate compacts so that our reserves may be expanded and used in the public interest, but guard against any danger of misusing conservation laws to restrain unduly any operator. Administer the public lands, not primarily as a source of governmental revenue, but for the purpose of stimulating private initiative in discovering and developing oil on the public domain.

2. Utilize the facilities of Government to promote research in the manufacture of synthetic liquid fuels, but without permitting governmental competition with private industry. Enact such legislation as may be necessary and proper to encourage secondary recovery from old fields which otherwise would not be productive.

3. Encourage free competitive enterprise by tax reforms to provide incentives for the risk of private capital in new ventures. Maintain the atmosphere in which competition may survive by enforcement of the antitrust laws. Adhere to the Federal statute prohibiting interstate shipments of petroleum produced in violation of State law. Continue the provisions of the income-tax law permitting deductions for depletion and intangible drilling costs.

4. Require full disclosure to the appropriate agency of Government of the principal terms, conditions, and obligations by which American companies undertake to carry on the petroleum industry abroad.

5. Follow a foreign policy designed to promote full development of the petroleum resources of the whole world for the benefit of all peoples of the world; to secure adequate supplies of petroleum to all peoples; and to discourage artificial restraints and restrictions, both political and private, which deny full opportunity for the people of all lands to participate beneficially in the production and distribution of petroleum and petroleum products.

That is the policy, and it expresses in a few words what in my opinion is the basis and foundation on which the oil industry can best contribute its share to the national welfare. Thank you.

The CHAIRMAN. That report was filed with the Senate by the chairman in January of 1947. Needless to say, the chairman is very pleased that it is still remembered by members of the oil industry. Perhaps it might be appropriate for me to say that by the stimulation of exploration on the public lands under a law which Senator Hatch of New Mexico and I introduced, and which was enacted, the State of Wyoming became the first State in the public-lands States in the production of oil, and the fifth State in the Union. So, by the proof of what happened in one State, I think the value of at least a part of that policy has been demonstrated.

Since you brought up the question, Mr. Jacobsen, I felt free to make that comment.

Mr. JACOBSEN. Yes. I would only add this statement, if I may: That the benefits of it are not limited to any one State.

Senator O'MAHONEY. Oh, I know that.

Mr. JACOBSEN. If we are as well off as we are today in the way of production capacity, it is due to the fact that the oil industry has by and large been operating precisely on the basis of the policy that you suggested.

The CHAIRMAN. Mr. Cooke.

Mr. COOKE. I wonder if Mr. Jacobsen would agree that the general policy should be extended to all energy sources?

Mr. JACOBSEN. That policy was, as I understand it, and in fact I know it was, directed specifically to the oil industry. I do not know

enough about coal or the electrical industry to say how far the same principles would apply. I do know as far as oil is concerned it is a policy which better than any other that I am acquainted with would enable the oil industry to do its best for the national welfare.

Mr. COOKE. Then the oil industry would generally support the same principles for the coal industry?

Mr. JACOBSEN. I cannot speak for the oil industry, and I do not know enough about coal. Of course, there are a good many things that are different. For instance, the coal industry having the very large reserves that we were told about yesterday, the coal industry certainly does not need the same incentive to go out and continue to explore. So I do not know to what extent you could apply the policy that I just spoke of to the coal industry.

One of the important things in connection with the oil industry is that the policy outlined would encourage further exploration and development. In coal, as I understand it—and I know very little about it—there is no particular need of additional exploration because the coal industry has such large reserves.

Mr. COOKE. I would say that that is definitely not true. Your cost of going in the coal business is constantly mounting. Your exploration is mounting.

Mr. JACOBSEN. That just proves my ignorance of it, as I stated. I really do not know anything about coal.

Mr. WILSON. If you have proven reserves, why do you need to go out and explore for it? You have 2,000 years of proven reserves.

Mr. COOKE. Our proven reserves, like your reserves, require development and require further drilling and exploration. That is, close drilling and close development. It is not a case of when you go to develop your reserves——

Mr. WILSON. I am not talking about development, but about exploration. I agree that development is necessary in both cases.

Mr. COOKE. I am speaking of development and exploration in the coal industry in the same sense.

Mr. WILSON. Well, Mr. Jacobsen was talking about exploration in the sense of really going out and trying to find a new place to drill, and drilling their dry holes to get a producing well in their wildcat operations, which is certainly quite different from coal.

Mr. POTTER. Not so much different. There are many instances in the coal industry where we will spend $50,000 and $100,000 in diamond drilling just to try to find coal. It is not entirely different.

Mr. COOKE. We have the same problem, except in a varying degree of expense.

Mr. Chairman, it was indeed gratifying at the panel discussion yesterday to note the pervasive and underlying concept of the public interest that underlay the questions of the chairman and the members of this committee. I have, of course, no intention to reflect upon my fellow panelists or myself when I state that our approach necessarily is affected somewhat by our particular point of vantage. To this committee falls the vital function of evaluating the statements of position of the various groups, all with a view of assessing the direction in which the public interest may best be served.

It seemed to me, as I listened to yesterday's discussion, that the issue that presses for resolution by this committee clearly appears. Everyone agrees, that the known reserves of liquid fuels and gaseous

fuels are limited to 14 years and 29 years, respectively. I am sure all would also agree that if it were also clear that there were to be no additional discovery, it would be foolhardy not to establish at this time a national fuels policy which would take into account the short-term availability of liquid and gaseous fuels.

Our oil and gas friends urgently proclaim that vast amounts of additional reserves will be discovered in the years to come. The question which this committee will have to resolve is whether the public interest will permit an acceptance of those undocumented prophecies. Undoubtedly, the committee, at the formal hearings to follow, will want to invite the oil and gas industries to come forward and place in the record all of the existing data and technical knowledge that would warrant the committee in departing from the known reserve figures. In other words, gentlemen, it appears to me that the burden lies with those who contend that at some time in the indefinite future, something of uncertain amount will be added to what we now have.

I would like to restate the issue, as I see it. The ordinary competitive fluctuations as between competing fuels industries are of no importance in this survey, as such. The only pivotal question is whether the Government and the public can safely proceed on the assumption that our present fuel-burning methods can be satisfied for a long enough period of time in the future, particularly with reference to those mobile and other uses for which, in present technology, petroleum and gas has no substitute.

Everyone seemed to agree yesterday that the crucial question was the reliability of petroleum and gas reserves and productive capacity in those industries in the light of the expectable demand that lies ahead. If this committee should be satisfied, after hearings, that there is no need for fear on that score, it seems to me that it would have completed its job for the time being. On the other hand, if the opposite should appear, the other aspects of the situation would have to be explored. Accordingly, I would recommend to this committee for its consideration that its initial hearings be limited to the questions which I have suggested.

The extreme urgency of this inquiry is certainly dramatically revealed by the memorandum of the Munitions Board with which the chairman initiated the discussion yesterday. This memorandum demonstrates that not 25 years from now, not 10 years from now, but right now the gas and oil industries are not in a position to supply the needs of our defense economy. Certainly in the light of this conclusion, it would be nothing less than gross neglect not to take stock immediately of the security of our future fuel economy.

With perfect amiability, I would like to suggest that some of our friends at the other end of the table made statements yesterday somewhat more enthusiastic than they have made in other forums. Perhaps we ourselves, in the cross-conversation, did some of the same. At the formal hearings we hope to be able to present to the committee a complete catalog of all of the expert opinion of the various industries as it has previously been developed in other forums and other circumstances. I would like at this time, however, just to indicate that some of yesterday's enthusiasm must be appraised at least in the light of some recent utterances from the oil industry and governmental experts.

We have a bracket of three studies that have been made from time to time. One by Mr. Hopkins of the National Security Resources Board, one by Mr. Solliday of the Stanolind Co., and the third by Mr. Schroeder of the Bureau of Mines in the Department of the Interior. Varying only in amount, all three of these experts agree that by 1965 there will be a deficiency in domestic petroleum production as against domestic demand of from 2.5 million barrels per day to 4 million barrels per day. It is also important to note that, as we understand these figures, they did not include an allowance for the stepped-up demand incident to a military emergency, which, for example, during World War II added to the demand by as much as 1.3 million barrels per day.

In other words, when considered for a period of military emergency, the deficiency would have to be increased by that amount. It is not possible within the limits of this panel discussion to present all the various opinions and match them one against the other. We feel that when all of the evidence is in, after the hearings, this committee will have ample reason to be concerned as to whether the public can safely continue to assume that the petroleum and gas industries will develope in the future the reserves and the productive capacity which was asserted here yesterday.

I think it is fair game to test the other fellow's proposal against its logical implications. Accordingly, I have no quarrel with the gentlemen who yesterday were anxious to suggest that we were urging for a program that would tell the individual consumer, by governmental compulsion, which fuel to burn. I say this is fair game as a matter of advocacy, but the coal industry makes no such proposal. Undoubtedly, there are many courses of action that may suggest themselves to this committee upon conclusion of its hearing. Not the least of these certainly is a further intensification of the synthetic-fuels program with reference to which the chairman of this committee and some of the members have already rendered such a valuable public service. The committee will have to decide how long the Nation can afford to wait before a synthetic-fuels industry is fully activated. I gather that some of the gas and oil gentlemen, while offering no objection to its remaining in the research phase, do not look with too much eagerness on its being launched as a commercial project.

The length of time and the safety with which the vast potentiality of a synthetic-fuels program can be kept in the laboratory stage and the apparent wishes of the petroleum and gas industry honored are matters this committee will have to determine, all in the light of the conclusions it reaches, after the hearings, as to dependable reserves and productive capacity.

In closing, I would like to refer to the resolution pursuant to which these panel discussions are taking place. That resolution authorizes and directs the committee, among other things—

> to make a full and complete investigation and study of the available fuel reserves of the United States and the present and probable future rates of consumption thereof.

It is that comprehensive and all-important task to which the committee, as we understand it, will devote itself at the public hearings. The committee may be assured we will cooperate with it and its staff in every possible way. Certainly everyone will desire to aid in

every way so that, in discharge of its obligations under the resolution, the committee will be able—

to formulate a national fuel policy to meet the needs of the United States in times of peace and war.

Senator ANDERSON. Thank you, Mr. Cooke. Well, I think that opens up a little field for discussion.

Mr. JACOBSEN. Mr. Chairman.

Senator ANDERSON. Yes, Mr. Jacobsen.

Mr. JACOBSEN. This memorandum says that the fact is that right now the oil and gas industries are not in a position to supply the needs of our defense economy. I certainly do not think that the implications in that statement are warranted, and I do not know if it would be entirely out of order for me to suggest that Admiral Burton B. Biggs be asked to express an opinion on it. Am I out of order in that, Mr. Chairman?

Senator ANDERSON. No. Admiral Biggs is here, and we are glad to have him here; but the point Mr. Cooke raises is that the memorandum from the Munitions Board, he says, demonstrates that point.

Mr. COOKE. That is right.

Mr. WILSON. If you read that memorandum from the Munitions Board, of which I have a copy, it says that the only shortage is in reference to a shortage of tank cars, tankers and pressure tank cars, which is a very special and temporary thing, and mainly due to the railroad strike.

Mr. JACOBSEN. And does not refer to oil products.

Mr. WILSON. That is right.

Senator LONG. May we see that memorandum? I do not have a copy of it myself.

Mr. COOKE. Here it is.

Mr. WILSON. The references are in paragraphs 5 and 6, where it speaks of the shortage of tank cars and tankers under fuel oil and pressure tank cars under propane, which are the only shortages mentioned.

Senator LONG. Could that shortage be partly removed on transportation facilities by a greater development of our inland waterways and barge facilities?

Mr. WILSON. Very little liquefied petroleum gas moves by barge. I presume it would be possible.

Senator LONG. Of course, moving oil is a different proposition.

Mr. WILSON. Yes; moving oil is a different proposition. I think in general where those facilities are available they are being used, and the use of tankers and tank cars is in areas where it would not be feasible to use barges.

Senator LONG. I have been getting up some statistics and having some compiled for me that indicate it only takes about half as much steel for a ton of carrying capacity in barges as it would be in tank cars.

Mr. WILSON. That is undoubtedly true, but unfortunately where you can move by barge is limited. I think in general the oil industry, because of the economy, is using barges wherever they can be used.

Senator LONG. One other point I had in mind is this: Those same statistics indicate that a modern tow, particularly a modern, integrated-type tow, gets far more—that is, about 50 to 100 percent more—distance in a year, as well as having more carrying capacity

per ton of steel, than you do with a standard railroad tank car. Have you ever had any chance to compare that?

Mr. WILSON. I know it is definitely more economical to move by barge where the rivers and lakes and inland waterways lie in the right places.

Senator LONG. If you do not have enough steel to go around and can use waterways, your steel can be more economically put into barges than it can into railroads cars.

Mr. WILSON. My only point is because of the fact that it is low-cost the industry is already using it about everywhere it can be used. Of course, as our demand goes up, we have to increase barges just as we have to increase other things.

Senator LONG. One point in that connection is this: We could shorten the route on the inland waterway on the Mississippi by 100 miles, for example, simply by improving one waterway at the cost of a quarter of a million dollars or a half a million dollars, and at the cost, I believe, of about $25,000,000 we could shorten enormously the distance on the coastal route of the Intercoastal Waterway delivering oil into this area from the Texas area.

Mr. WILSON. I am sure it would not pay to barge oil all the way up, as against tankers. It is so much more economical to handle it in large units like tankers, as against barges.

Senator LONG. Of course, in the event of war you might lose a lot of your tankers to snorkel submarines.

Mr. WILSON. I do not believe we would lose very many, but that is getting into a field you probably ought to ask the military about.

Mr. POTTER. But Mr. Jacobsen's testimony gave one example of a petroleum and petroleum-products shortage that affected us. The natural-gas shortage this winter actually stopped the production of silica brick, which is used for coke ovens, which, in the final analysis, will actually hamper our meeting the M-day requirements on steel products. It actually pushed back the steel production.

Mr. WILSON. But it was a shortage of pressure tank cars and not liquefied gas, which is running out of our ears in Texas.

Mr. POTTER. It had nothing to do with tank cars and liquefied-petroleum products. I stated it was natural gas.

Mr. KAYSER. The shortage was not due to the lack of production capacity, but the lack of pipeline capacity to the area.

Mr. POTTER. Our argument is: If you do that on peacetime demands, how are you possibly going to take care of a war economy?

Mr. WILSON. By building more pipelines and tank cars and tankers.

Mr. POTTER. And shutting off the supply of materials which would make it possible to give you more steel, by cutting out the building of those plants for steel production. I cannot understand that, sir.

Mr. JACOBSEN. The point I wanted to make is in regard to this very short sentence, which says:

> This memorandum demonstrates that not 25 years from now, not 10 years from now, but right now the gas and oil industries are not in a position to supply the needs of our defense economy.

As I read it, the statement from the Munitions Board does not say that, and I think it is a misquotation. That was the reason, Mr. Chairman, I called attention to it.

Senator ANDERSON. Could we have any comments you care to make at this point, Admiral Biggs?

Admiral BIGGS. Mr. Chairman, I feel a certain hesitancy to appear before this group of experts on this subject. I think the argument there, Mr. Chairman, hinges on what we mean by the last phrase of "our defense economy." From a purely military standpoint, at the present time we are able to obtain the petroleum products required by the military. That is a matter of demonstrable fact.

The matter of the definition you might place, Mr. Chairman, on "the defense economy" is a horse of an entirely different shape.

Senator ANDERSON. Yes. For example, would it not be proper to point out that we might be able to say that the steel capacity is enough to take care of the military, because if the military wants to it can divert 70 million tons of steel or 90 million tons of steel to the military, but then what would the rest of the economy have? I think we would like to know if you can comment on the entire defense economy, which includes more than the military.

Admiral BIGGS. I might point out, Mr. Chairman, taking the other example that I happen to know about, that the requirements of the military side of the family in petroleum products alone in World War II amounted to, in the oversea consumption—direct military consumption—approximately 21 percent of the available supply. The essential economy to support that military effort consumed the other 79 percent.

The various items which enter into our defense economy to build ships, tanks, and airplanes, and to produce those basic materials required—I would be extremely presumptuous, Mr. Chairman, to try to estimate the intricate interrelationships between all of those. Whether it can be done to a full extent is something that I believe the defense production authorities and the mobilization authorities are working on for long hours right now, sir.

Senator LONG. Do I understand the military directly consumed 21 percent of the petroleum production?

Admiral BIGGS. The direct military combat consumption amounted to approximately 21 percent of the United States production.

Senator LONG. You have no way of estimating how much was consumed in building military equipment, and that sort of thing?

Admiral BIGGS. I have not. All we have is that the remainder of approximately 79 percent was consumed in the essential economy which supported us.

Senator LONG. But do you see the prospect of enough fuel or enough expansion of fuel capacity in the event of another war, particularly in liquid fuels? It would probably demand a tremendous reduction in many of our civilian uses of liquid fuels, just as it did in World War II; would it not, Admiral?

Admiral BIGGS. There is a very definite indication, which was stated, I believe, before one of the House committees in June of 1949, that there would have to be rationing of liquid fuels. One of the principal reasons for the memorandum you have before you is that it would be certainly impolitic at least for the military services to demand liquid fuels for everything, or gas. The basic concept is that we do not feel that we should be put into the position of being criticized for not taking advantage of all fuels in the most effective manner, so as to put the

least strain on the transportation and to make sure that all of the assets we have are used effectively in the defense effort.

Mr. WILSON. Mr. Chairman, I agree with Mr. Cooke's viewpoint that the biggest question we need to answer here is the adequacy of the ability of different industries to meet the military demand, and I have prepared a brief statement on that, which I think would be appropriate at this time, if I may.

Senator ANDERSON. I would be glad to have it if you will comply with a request and comment on this chart which I will hand you, which is a statistical chart prepared by the Petroleum Administration for Defense as of January 1951.[1] It attempts to show the crude production and the productive capacity, and it shows that there was a gap in the first 6 months of 1950, but by the time the Korean matter had broken out the two lines were just touching. Then there was a little drop-off because probably the early scurrying had finished, and now they are coming together.

The maximum efficient rate of production for crude oil in the country is coming close to the line of the needs of our actual production.

Mr. WILSON. I would be glad to look at that and give you my opinion.

Senator ANDERSON. There does not seem to be too much reserve between the two lines, but I would be glad to have your comments on it.

Mr. WILSON. I will be glad to do that.

Senator ANDERSON. You may go ahead with your prepared statement.

Mr. WILSON. One of the questions raised by both the report on energy resources and by some of the coal industry representatives is whether or not the oil industry can further expand to meet prospective war needs. If it cannot, some Federal action might be justified; if it can, it would seem to be generally agreed that the free competition within the industry and between the fuel industries should continue, rather than trying to interfere with the free choice of customers as to what fuel they wish to burn. Certainly to give any industry a Government-established monopoly on any group of customers is foreign to our American system.

Probably the best indication of an industry's willingness and ability to expand is to look at its record. Industries, like individuals, do not stop growing suddenly—what usually happens is a gradual slowing up in the rate of growth over a period of years. Has our industry shown any such indication? Far from it—let us look at the record of growth starting with table A, page 3, of the energy resources report. (I have added the Bureau of Mines figures for 1950.)

	Increase in quadrillions of B. t. u.
Between 1900 and 1910	0. 8
Between 1910 and 1920	1. 4
Between 1920 and 1930	2. 6
Between 1930 and 1940	2. 6
Between 1940 and 1950	3. 6

In other words, not only has the total output been gaining steadily, but the rate of increase is still increasing.

[1] Chart appears in appendix 1, p. 111.

Looking at the details of the demand (and supply) increase during the 1940–1950 decade:

	Percent		Percent
Gasoline	69	Other products	87
Kerosene	72	Total domestic	79
Gas, oil, and distillates	146	Natural gas	125
Residual fuel	63		

Substantially all of this tremendous increase, costing well over $15,000,000,000 was made without Government assistance or central planning—merely because we had a vigorous, competitive industry, operating with a minimum of controls and with adequate incentives over most of this period. We paid good wages and supplied our products at prices which showed less increase than those of any other major commodity. Surely this record entitles the industry to the confidence of the public and the Government.

But what about meeting the demands of an all-out war? It is hard to answer that for every possible type of war because no one knows the demand figure, particularly after the first year or two, and there are so many possible assumptions as to whether we would lose the Middle East refineries, or the Middle East crude supply (which is much less likely), and whether or not in that event we would have to supply western or southern Europe, and so forth. Possibly as good an approach as any is the one used in the first question posed in the list submitted by Senator O'Mahoney in his letter of transmittal, namely, whether the fuel industries could increase their output by 25 percent to meet the needs of a wartime economy.

In the case of the oil industry, the answer is easy. If you are inquiring about such an increase above the 1949 figures, which are the last ones given in the report, we can do it tomorrow—in fact, we are almost doing it today, though admittedly this represents the normal seasonal peak of refining activity. However, little more than an increase in tankage to store seasonal products would be necessary to sustain this rate for the whole year.

If you are talking about an increase of 25 percent, or roughly 1,400,000 barrels per day over the average 1950 rate of refining and production, even this could readily be met, though it would require some refinery rehabilitation and some more transportation and storage facilities, as well as a continued high rate of exploration and drilling activities to sustain it. Gas is in about the same situation.

On top of that we could produce more oil from existing wells in Canada and Venezuela, as well as in this country, but refining facilities would have to be built from the ground up.

In addition, in the event of war, relatively moderate rationing could add another million barrels per day to our supplies available for defense needs, and this last amount alone would about equal Russia's total supply.

All these things should certainly be done before we need even give serious consideration to synthetic fuels—and when we do, it is my belief that even beyond these major low-cost increases, expansion of petroleum production and refining will cost less in money, manpower, time, and steel, than synthetic fuels.

Just one word of caution is necessary. Finding new oil supplies is getting more and more expensive, and to do this job we would have

to have the maintenance of present incentives, including the depletion allowance which merely furnishes the capital to let us replace our reserves. And we must have a continued flow of geologists, engineers, and scientists to continue our exploratory, development, and research efforts at accelerated rates.

In this connection, I must stress the tremendous part played by technology in making the foregoing progress possible.

Thirty years ago we had practically nothing but surface geology to go on. Any structure that did not appear on the surface we had no way of locating. We had first the development of the gravity meter, then of the magnetometer, and more recently of the flying magnetometer. However, the most valuable of our tools in exploration is the seismograph developed about 30 years ago. I may say that the seismograph has been improved every year.

Again and again we find that going over areas with the more sensitive and accurate devices we now have gives us indications of structures two or three miles below the surface which gave us no indication a few years ago of their presence.

In drilling we have better designs of every piece of equipment that goes into drilling. The metal in the bits, the metal in the tubing, and everything else. All of it sums up in the fact that today we are drilling three times as deep as we were back in 1920, and we are continuing to make improvements along those lines. Those deep wells are expensive, but in a sense they treble the amount of the earth's volume in which you can expect to find oil.

Senator LONG. Just how far do you expect to go in drilling deeper? Do you have any indication that you have even begun to reach the point where you could not expect to find oil by drilling deeper?

Mr. WILSON. Certainly there is no limit to the depth at which we can expect to find oil in many territories. Of course, occasionally you get to granite before you get down 10,000 feet.

Senator LONG. So far about 15,000 feet is as far as you have found it practicable to go, is it not?

Mr. WILSON. We have drilled to 20,000 feet. However, it takes a pretty rich field to justify that deep a well, but 5 years from now I think 20,000 feet will become fairly common.

Senator LONG. The cost is progressively more expensive, is it not?

Mr. WILSON. It goes up at least as the square of the depth, if not more. Our surveying methods have added greatly to our ability to get oil. It used to be that we would have to take a few cores where we thought oil would be, but in passing we missed a great many fields. Now, when we drill a well we survey with a special bit which gives us a bearing on the oil content of all the various sands you passed through on the way down. Those are carefully recorded. Then we may put in casings to the most promising point, and produce that for a few years. Then we will pull back up the hole to where the records have shown there is another producing horizon, and shoot holes into the casing with a gun perforator, which is another new development, and we produce more and more.

The acidizing procedures have tremendously increased the recovery of oil from our limestone reservoirs. We have long known acid, of course, would dissolve limestone. The question was how could you get the acid down 2 miles without eating up all the steel pipe; but we found a way to make the acid act on the rock and not on the steel.

The hydrofrac process is a method of shattering rock formations at great depth and holding them apart, and it has tremendously increased the productivity of wells in certain areas. I understand the Sprayberry sand which appears in a great many wells in Texas would probably not be economically feasible to work to a great extent if it were not for the development of this method.

I may say all of these new methods are available generally to the industry on a very low or no royalty basis. In some cases there was a royalty, but now the patent has expired. The industry does not keep these secret. It publishes papers on them, and generally has various companies handle them.

Secondary recovery methods are just in their infancy. Oil recovered by pumping back gas or pumping in water below the formation tends to be more expensive than that which comes by natural flow; but as the demand for oil goes up, we will steadily increase, as we have in the past, the amount of oil we get from even old fields, which we have not counted on, by going to secondary recovery methods. That will be so especially if we maintain the depletion allowance, and if the price improves somewhat further.

When we go into refining there is a whole additional amount of research to describe that would take too long. In regard to the cracking, the first development of cracking at one swoop doubled the amount of gasoline we could get from crude oil. As a matter of fact, if there were not the demand for other products we could make three times the amount of gasoline that naturally occurs in crude oil. Catalytic cracking is also very important. Catalytic cracking is doing what our coal friends desire, that is, converting more and more of the heavy residual fuels into distillate fuels. But that cannot be done completely today. Many think it is done to the extent which seems economically practicable under a given set of conditions.

On top of that is the whole technology of synthetic fuels which, even though we do not think we are going to need them for 10, or 15, or 20 years, we have worked actively on them, and will continue to do so.

Mr. COOKE. Dr. Wilson, I wonder if I might ask a question here?

Going back always to the proposition that you do have 14 years of oil in front of you, do I take it all of the developments you have been speaking about in improved techniques are well in effect in this current year of 1950?

Mr. WILSON. I think that all I mentioned are actually in use today, but they—particularly the secondary recovery methods—have not been applied to any large number of fields, nor has the hydrofrac process been applied to any large number of fields, but they are mainly signs of what technology has done and will continue to do.

I do not know the names of the discoverers who are going to make further advances next year, but I think that there will be some.

Mr. COOKE. I wondered in the light of that if you had any comment to make on this American Petroleum Institute report [1] which was just issued, which showed that your additions to reserves in 1950, that is, the increase in total reserves during 1950, amount to about 1,100,000,000 barrels, as against 1,600,000,000 barrels in 1949.

Mr. WILSON. I believe that figure was given yesterday.

[1] Annual reports of the reserve committees of the American Petroleum Institute and the American Gas Association are included as appendix 2 of this print.

Mr. COOKE. Is there any occasion for the drop, or any particular significance that should be given to it?

Senator ANDERSON. Would not the fact that it is mighty hard for independents to get a hold of casing have something to do with this figure?

Mr. WILSON. I might say it is mighty hard for the majors to get casing too, sir.

Senator ANDERSON. I do not know anything about the problems of the majors, but I know something about the problems of the others.

In other words, Doctor, let me ask you this: When these rates drop off, as they do, and as they seem to, if there is a shortage of steel, would not that be expected, more or less?

Mr. WILSON. Definitely. As Mr. Ed Warren mentioned yesterday, the rate of discovery would drop off during the war period. I wonder, Ed, if you would mind repeating those figures? I do not think they all got the significance of the rate of discovery over the rate of use over the three time periods.

Mr. WARREN. The nine prewar-year average of discovery rate, that is, new reserves, averaged 1.26 barrels per barrel produced. During the four war years it was 1.13 barrels.

Mr. WILSON. That is reflected in the shortage of steel and price ceilings.

Mr. WARREN. And from 1946 to 1950, inclusive, 1.65 barrels.

I understand this last year, which has not been figured, was 1.5; but in these figures you have to take a 3 or 4-year average to take care of the differences in addition and subtraction.

I understood from somebody on the committee that they subtracted something like 300,000 barrels of propane from Scurry County last year, and the actual new discovery rate, taking that into consideration in the year's average, was about what it was before.

Mr. WILSON. Now, in spite of the fact that the rate of consumption has gone up very sharply since before the war, the average rate of discovery in the five postwar years is practically the same relatively in ratio to the consumption as it was before. In other words, we discovered about 60 percent more oil in a given year than we used up.

Senator ANDERSON. I was trying to get to the question as to what the relationship of steel is to the amount of new oil you bring in, and thereby add to your reserves?

Mr. WILSON. It has a very important relationship. Yes, sir.

Senator ANDERSON. Is it not a fact that many people would like to have drilled more wells than they did drill, but could not get steel for them?

Mr. WILSON. That is true. To give the wildcat wells steel is more important, and that has been given a special preference now.

Senator LONG. It has been suggested the major oil companies, particularly those affected by the excess profits tax, in time of war when the tax was on them were more inclined to do wildcatting work than they were before. In fact, they did a lot more wildcatting because of the excess-profits tax. Do you know whether that is true or not?

Mr. WILSON. I doubt it, because during the war the pressure was so hard on us to produce all the oil we could that I do not believe there was any sharp increase in wildcatting during that period.

Mr. WARREN. I have figures here that might be helpful. They give you the criterion of new reserves per foot of hole drilled. That is one index used in the industry.

In the prewar years, when we discovered 1.26 barrels of oil for every barrel produced, the number of barrels was 24.5 of reserves.

In the 4 war years it was 24.6.

In the last 5 years it has been 25.9.

Mr. WILSON. But the question was whether there was an abnormal amount of wildcatting during the war years because of the excess-profits tax.

Mr. WARREN. The relation between footage drilled and the amount of reserves, I think answers that.

Mr. WILSON. It shows no appreciable change.

Senator ANDERSON. How does it answer it? It does not answer it to me at all. I do not understand it. The question is whether there was undue drilling, or excessive drilling, or increased drilling—put it any way you wish—during the war period because of the excess-profits tax. The number of barrels per foot does not tell anything about it. The number of wells drilled would answer the question, would it not?

Mr. WARREN. I have the figures here, Senator, but the point was the discovery rate per foot was the same.

Senator ANDERSON. I would still appreciate an answer to the question.

Mr. WILSON. I think we ought to have the wildcat figures, if you have them.

Senator ANDERSON. The question was quite plain, was it not? I mean, I could understand it, and if I could, it ought to be easy for anybody here. He asked whether or not during that period when you had an excess-profits tax, the major companies increased their drilling. I do not think you want that question left open in the record without some answer to it.

Mr. FELL. Senator Anderson, I might answer that this way: That the limitation of oil by the tubular goods available made that impossible, and I can give you some figures here to show that point, I think rather clearly.

Mr. WILSON. I have the answer right here.

Senator ANDERSON. I am sure that there must be an answer to it, and I am sure the answer must be "No."

Mr. FELL. The anser is "No" because the tubular goods were not available to drill the wells with.

Mr. WILSON. Let me give you the actual figures, Senator. These happen to be in 3-year groups—1937 to 1939, inclusive, 6,500 wells. I won't give the odd numbers; 1938 to 1940——

Senator ANDERSON. Excuse me, Doctor. Just to help me along, is there any differentiation there between wildcatting and proven wells?

Mr. WILSON. These are wildcats only: 1938–40, 6,600 wells; 1939–41, inclusive—and we are taking a 3-year average in each case, which overlaps—6,900; and 1940–42, 6,700; 1941–43, 6,600; 1942–44, that is, for the heart of the war years, 6,700; 1943–45, 7,400; 1944–46, 8,300; 1945–47, 9,300; 1946 to 1948, inclusive, 10,800.

Senator LONG. Of course, that does not show what the difference might have been between the independents and the majors. I have

been told by some independents they almost had to stop wildcatting during the war because they simply could not get the steel even to drill their ordinary wells, developing the leases that they held. Do you know anything about that, Mr. Jacobsen?

Senator ANDERSON. Is not that a question that should be directed to somebody who represents the independents?

Mr. JACOBSEN. I speak for Amerada.

Senator ANDERSON. Let us get a small one. I think most people know Amerada is not a beginning venture, at least.

Mr. JACOBSEN. But we are independent in the sense we only produce crude.

Senator ANDERSON. In the view of the antitrust laws I hope all of us are independent. Have we someone who speaks for the small independent?

Mr. WARREN. I might say from my own experience with the small independent during the last war that we had control of the wells that were drilled as to space, and in order to save steel, but wildcat wells were encouraged by the PAW at that time as much as possible. In other words, they wanted to get as much oil discovered as possible. Wildcatting ventures during the last war, from any source, were encouraged.

Mr. WILSON. And steel was provided, of course, whether they were large or small, was it not?

Mr. WARREN. I think that was probably true. Yes.

Senator ANDERSON. Was it not true also that if you went into a new area relatively unproven and bought a discovery well you had very little trouble getting steel from that time on for wells in that vicinity?

Mr. WARREN. If you made your findings on the basis of spacing and everything, you got your steel allocated; but it was a steel-saving proposition in the last war. The average number of wells dropped considerably from an average of 27,000 wells per year in the nine prewar years down to 23,600 wells during the war years. Since that time the total wells, that is, development wells and wildcats, have averaged 37,000 wells per year.

In other words, we had a tremendous drop in development during the war period, and everybody had difficulty.

Senator ANDERSON. Does not that give an answer in a way to the question as to whether they drilled more during the period of the excess-profits tax and then stopped? Because this would indicate that 10,800 were drilled in a period after the excess-profits tax was repealed.

Mr. JACOBSEN. I think that was a coincidence, Senator. The main reason for the drop in total number of wells—and you will recall, Mr. Wilson pointed out the wildcats did not change much in number—the main reason for the drop in development wells was the one that Mr. Warren just referred to, namely, that the PAW and all of the State regulatory bodies for the purpose of saving steel encouraged wider spacing of wells. Instead of drilling 1 well to 10, or to 20, we drilled 1 well to 40 acres.

Senator ANDERSON. I agree with that, but if you had a set of figures which showed the average rate had been 6,500, 6,600, 6,700, and 6,600 during the period when the excess-profits tax was in effect, and then after the excess-profits tax was repealed the wildcats jumped up to

10,000, it would certainly indicate that there was nothing to the theory that the wildcat drilling increased while the excess-profits tax was on.

Mr. JACOBSEN. It just happens to be the opposite.

Senator ANDERSON. I would think so.

Mr. TAGGART. Mr. Chairman, on the matter of steel, while you are on that subject, would it be inappropriate to ask, bringing it up at the present time, as to what the requests and requirements for steel of the oil and gas industry might be currently, and ask the coal people what their requests or requirements for steel might be with relation to the percentage?

Senator LONG. Could someone give us those figures?

Senator ANDERSON. I do not think it would be inappropriate at all, sir.

Mr. TAGGART. I think it would be very appropriate.

Mr. WILSON. We will certainly get the figures. I do not know whether anyone here has them or not. They have been prepared by the Petroleum Administration for Defense and submitted to the National Petroleum Council, I believe.

Mr. TAGGART. Do you know approximately?

Mr. WILSON. I could give you the figures from my mind. Is Russell Brown here? He was chairman of that committee. What are the steel requirements of the oil industry for 1951 in tons?

Mr. BROWN. That is including ships and everything else. That includes tanks, and shipping, and all transportation, and all pumps, and so forth. I think it is in the nature of 10,000,000. Maybe we have the exact amount here. In the nature of 10,000,000 tons.

Senator LONG. Could you give us a breakdown of how much of that is for wells, and how much is for pipelines, and so forth?

Mr. BROWN. Approximately 1,890,000 is for what we term "oil country goods" That is the actual wells. It has nothing to do with transportation. The total figure I was thinking of on all products was 11,284,000.

Mr. TAGGART. That is 11,000,000 and that is confined to oil, or is that oil and gas?

Mr. BROWN. That is oil and gas, and transportation in both.

Senator LONG. But out of that there is 1,800,000——

Mr. BROWN. 1,890,000 for production.

Senator LONG. For the production?

Mr. BROWN. For oil country goods.

Senator ANDERSON. Have you a figure on the number of wells? I think they announced it would take care of about how many wells?

Mr. BROWN. That contemplates about 44,000.

Senator ANDERSON. 44,000 wells.

Senator LONG. Actually there is less than 20 percent then. In fact, it looks to be only about 15 percent that is actually for your production of oil.

Mr. BROWN. The whole production, which contemplates your tanks, and all that, would run in the nature of about 3,240,000.

Senator LONG. That is including tanks and that sort of thing?

Mr. BROWN. Yes.

Senator LONG. That is 3,240,000.

Senator Anderson. If you have a breakdown, please give it to us.

Mr. WARREN. I might say this is an industry report set up by the National Petroleum Council that has been presented to the Interior Department. It is my understanding that the Petroleum Administration for Defense has probably prepared its own report. I can give you these figures, if you would like them, but I would like that to be understood.

Senator ANDERSON. Yes. The question that Senator Long raises and the point he makes is that we are talking about wildcatting and discovery of new reserves, and finding new sources of oil. Apparently 1,890,000 tons will be used for actual drilling, or oil country goods, that is, tubing, casing, and so forth; and 11,284,000 is the over-all figure. Now, what in the world is the rest of it, from 1,890,000 up to 11,284,000?

Mr. WILSON. Pipelines, tankers, refineries, and so forth.

Senator ANDERSON. By items.

Mr. WARREN. Here is each item on this report. Oil and gas production, 3,240,000 tons.

Senator ANDERSON. What is the difference between that figure and the 1,890,000 tons?

Mr. WARREN. That includes oil machinery and drilling equipment, equipment for leases, and so forth.

Senator LONG. Does that include your pipe and casing?

Mr. WILSON. Yes.

Mr. WARREN. Besides the oil country goods, which was drilling.

Senator LONG. What is the next figure?

Mr. WARREN. The next figure is oil transportation—1,497,000 tons.

Senator Long. Is that oil in terms of pipelines?

Mr. WARREN. 1,300,000 tons for pipelines; and tankers and tank cars is the balance of it, and tank trucks.

Senator LONG. 197,000 tons. What is the next figure?

Mr. WARREN. Drilling products. That includes plant facilities, and containers, and consumer storage, and liquefied petroleum gas.

Senator LONG. How much is that?

Senator ANDERSON. Butane tanks and so forth?

Mr. WARREN. Yes. It is 2,257,000 tons. I am giving you these in round figures.

Natural gas transmission, 3,022,000 tons.

Senator ANDERSON. How does that compare with what was used in 1947, for example?

Mr. WARREN. I do not have that figure, Mr. Chairman. Maybe somebody else does.

Senator ANDERSON. Three million what?

Mr. WARREN. 3,022,000.

Senator ANDERSON. Is that not abnormally large?

Mr. KAYSER. Not as against last year.

Senator ANDERSON. What about compared to 1947?

Mr. KAYSER. I would say that it might be a little larger than 1947.

Senator ANDERSON. When you say "a little," do you mean twice as large?

Mr. KAYSER. I have not reviewed the figures. I can do so, but I know that in general the development in the industry in 1947 was not quite as great. It was probably pretty close to the same. I would say it is about the same.

Senator ANDERSON. Take the 10-year average ending in 1945. How would it compare with the 10-year average ending in 1945?

Mr. KAYSER. It would be very, very much larger, because the natural-gas industry has developed to a greater degree from 1945 to date than it has at any other time in its history.

Senator LONG. How would that compare with 1948 and 1949? How would that figure compare?

Mr. KAYSER. It would be a pretty close comparison. The prospective development for the year 1951 is substantially the same as for the years 1948 and 1949 and 1950.

Senator ANDERSON. Of course, it would be unreasonable to ask anyone simply to stop a project under way and you would let them go ahead until it has actually been completed. However, as far as undertaking new projects, would it be reasonable to say we should not start new ones?

Mr. KAYSER. I think the only sensible thing to do is examine each project and see whether it fits into the economy. We were discussing that this morning with the gentlemen in the gas part of the PAD.

I want to say this too in that connection: That the gas section of the PAD is just now being set up, and its full report on the requirements is right now in process of being assembled. This seems to me like it is fairly close to what that report would be, although I cannot speak authoritatively on that.

Senator ANDERSON. Let us get the rest of these figures.

Mr. WARREN. That is the total. 10,672,000 tons. That is for domestic operation. Then there is the figure for foreign operation of 612,000 tons. That brings it up to 11,284,000 tons.

Senator ANDERSON. You mean in foreign operations we will get a third as much as all the oil-well development?

Mr. WARREN. It is 612,000 out of a total of 11,284,000 tons, and these are for American companies. Is that correct?

Senator ANDERSON. Well, the fact that it is an American company would not make any great difference, would it?

Mr. WARREN. I am just trying to define how it was arrived at. It does not take into consideration any steel they might get abroad for their operation.

Mr. WILSON. Senator Anderson, I can now answer your question regarding this chart that you handed me, if you so desire.

Senator ANDERSON. Yes. Go ahead.

Mr. TAGGART. Before we leave this question, Mr. Chairman, the statement was made that we could not consider a synthetic process because of the use of steel. That statement was not made by us, but was made by Dr. Wilson, as I understand it. Now has he any information upon which to base that statement as to how much steel would be required in synthetic processes, or anything of that kind, upon which he makes the statement which he did make?

Mr. WILSON. I have some information. There will be much more accurate information available in April by a committee working on that, but the reason I said we do not need to pay serious attention to it is because we could get this essentially from existing wells and existing refineries with a minor amount of rehabilitation, with some building of transportation and storage facilities.

There is no chance of synthetics competing with them. When you start to talk about ground-up building, there is room for argument,

and we will wait and see the figures to see which is the most efficient use of steel. However, I do not think there can be any reasonable argument with regard to these amounts which we can largely get from existing wells and existing facilities.

With regard to Senator Anderson's question about the curve of crude production approaching the upper line——

Mr. TAGGART. Before we leave that point, we would like to put into the record that for the coal industry steel requirements are estimated at 1,000,000 tons. I would like to call the attention of the committee to the fact that coal represents 39 percent of the total energy of the country.

Mr. WILSON. But it does not represent substantial expansion.

Mr. TAGGART. It does not represent a substantial expansion. Perhaps I would like to ask some questions about the expansion and reserves, if it would be an appropriate time, Mr. Chairman. I would not want to ask it if it is not an appropriate time.

Senator ANDERSON. I am not insisting on getting an answer to my question, but I would like to have that before we go on, if I can. If we can get that, I will promise to return to you later.

Mr. WILSON. The line which you indicated of crude production approached a number of times the average of three estimates of the maximum efficient rate.[1] I am not able to tell when those estimates were made, but it is obvious they are simply another example of how we do not know our own strength and vitality, because the latest estimate which was made is the lighter line well above that, which represents the National Petroleum Council's maximum efficient rate estimate which, as you will see, is very much above present production.

In other words, there is no question but that we today have five or six hundred thousand barrels a day more crude than we could produce from existing wells under the maximum efficient rate without new drilling. Therefore, this lower line is simply an earlier estimate which did not represent the facts, and we can shoot through that whenever we wish.

You understand, this does not represent any anticipated demand we are coming close to, but is simply the actual record of production against estimates of what the maximum efficient rate could be; and the earlier estimates were too low.

Senator ANDERSON. Thank you.

Now, Mr. Taggart, I am sorry.

Mr. TAGGART. On the earlier estimates and the new discoveries I have before me a statement which is an open letter by Mr. Ickes, written in 1947:

> For the sake of emphasis I would like to say again that we have not found as much oil in the United States as we have consumed during the past 7 years, although there have been unprecedented efforts made to discover new sources of supply.

Mr. WILSON. What is the date of that statement?

Mr. TAGGART. The date of that statement, I believe, is 1947.

Mr. WILSON. Well that is not a true statement.

Mr. TAGGART. May 30, 1947. Well, it indicates, at least, even though it may not be true, that there was not agreement on the subject and perhaps it should be explored.

Mr. WILSON. That is what we are doing here, I believe.

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[1] Chart referred to appears in appendix 1 at p. 111.

Mr. TAGGART. That is what we are doing; but as I got the inference yesterday, it was that some geologists—and their names were not given, and the place was not given—the inference was that they met and arrived at a figure of 120 billion barrels of additional discovery that could be anticipated. They used pencils in doing that, I understand from Mr. Ickes, because he goes on with the statement to say that more oil and gas have been discovered by pencil that have ever been found by drilling.

Now how much of your reserve of 120 billion barrels is below 20,000 feet, or something like that? How far did you go, and where did you find this? Can it not be documented in any way? Can it not be placed in this record so that the rest of us could look at it and find the places where you hope to make this exploration and this discovery, so that we do not have to base the economy of this Nation and its future defense upon what some group of people may have at some time said in some private conference?

Mr. MCCOLLUM. Mr. Chairman, my name is McCollum. I would like to address my comments to the point just raised, as well as the question, as I originally interpreted it, that was raised by Mr. Cooke. I feel it was like the question asked by my friend the other day, "Have I quit beating my wife?" I could not answer that question. The inference here is that we are withdrawing oil faster than we are finding it, and the statement is made we cannot supply a defense economy now.

There seems to be confusion, and I think it is confusion in the mind of my friend as to what we can discover, have discovered, and will discover.

Let me point out a fact there.

Mr. TAGGART. Let me ask you one thing there.

Senator ANDERSON. Let me say, I do hope we can finish. We are all trying to get this thing through as quickly as we can, and take as little time as we can, so if you can answer the question that Mr. Taggart raised, it would be appreciated.

Mr. MCCOLLUM. I shall do so.

Mr. TAGGART. Let me say I do understand your known reserves and your recovery. That was explained very thoroughly to me yesterday. It is the 120 billion barrels that you put in that you are going to discover at some future time and at some future place. That is what I do not understand, and that is what I would like to have explained.

Mr. MCCOLLUM. The statement was made yesterday that a number of geologists, or some geologists just a few years ago estimated that undiscovered oil reserves would be in the order of 120 billion barrels.

Mr. TAGGART. That is right.

Mr. MCCOLLUM. I made the statement again yesterday that since that time, as a result of developments, I think some of the men who made that estimate were pikers as to that estimate. Now, may I go ahead, Mr. Chairman?

Senator ANDERSON. Yes.

Mr. MCCOLLUM. You referred to these reserves, Mr. Cooke, and said that they were limited to 14 and 29 years, respectively, for oil and gas. Let me point out to you, in the use of these figures, some things that you ought to know. The United States Geological Survey—a

very excellent organization—back in 1922 estimated our reserves at that time as 5 billion barrels; and, doubtlessly, it was nearly correct. At that time we had a production of about 1½ million barrels a day or 500 million barrels per year. Since that time the oil industry has produced about 35 billion barrels, against the 5-billion-barrel reserve, and has a reserve today of approximately 30 billion barrels. That is 65 billion altogether.

Could that great organization—and I used to be a geologist—have seen then what we know today, they would have estimated that there was at least 130 years of reserves.

In other words the current proven or blocked-out reserves divided by the annual production, as you have done, does not give a true picture of the oil and gas reserves, because it does not consider the reserves that will be discovered this year, next year, and all of the succeeding years, and has little relation to the total remaining undiscovered reserves of the United States.

It is the use of these figures that is confusing. As demand increases the reserves increase. Except for a few depression years, when the demand declined and during the war year of 1943 when business was severely regulated, more oil was found and added to reserves each year than was produced. In other words, given an adequate economic incentive and freedom from regulation, such as you suggest or imply, the oil and gas industry can continue to supply all of the oil required. Oil reserves continue to increase with demand, and there is nothing to indicate a change in that relation.

The statement is made that we cannot supply the defense economy today. In Texas, according to the record, they are only producing 22 days a month. General Thompson, head of the Railroad Commission, submitted data to the Ways and Means Committee here only a day or two ago estimating there is present in the State of Texas alone something over 600,000 barrels a day of shut-in capacity over last year's daily average production.

Again going back to reserves, if you look at the record on page 173 in the monograph, Basic Data Relating to Energy Resources, compiled by this committee, you see the ratio declined only during those years in which we had controls. The ratio of oil and gas reserves has gone up, in comparison to production, every year except during the time we were under control, except that following that it stayed level for a time, and now it is going up again.

There has been an increase in reserves right along with the increase in demand.

The available reserves to be discovered is an unknown factor. The record reflects that almost every year in the history of the industry there has been additions to reserves; or, in other words, we have discovered each year more oil than we have produced. In addition to that, comparing it now with the record of the estimate in 1922, we would have had a 130-year supply. We do not know what the future will bring. We do not know how many years' supply there will be. We do not know how much undiscovered oil there is; but we must recognize that in using these figures we use only proven blocked-out reserves that are, broadly speaking, the current result of the highly competitive condition of this industry. That is the result of combining technology, as pointed out by Mr. Wilson, with an ample incentive to go out and search for oil.

Mr. TAGGART. Then is the statement that we have 120 billion barrels of future discovery withdrawn? I understand the past history of it. We are not completely uninformed as to how we figure our own reserves. We take so much in this territory, and take so much in that territory. We take the weighted opinion of people, and the engineers that we employ, and so on, and we add them together, and we get so much. Is that what the oil people do? Have they a penciled memorandum even that shows where they are?

Mr. MCCOLLUM. You asked me if it were withdrawn. I made the statement yesterday, or repeated the statement made by others, and if it has been withdrawn by us, it has been for the purpose of enlarging. I did not withdraw it in making the statement. I repeated what has been stated by others.

Mr. TAGGART. Will you place in the record, so that the rest of us may look at it, how you arrived at the figure of 120,000,000,000?

Mr. MCCOLLUM. I repeat this: That is an estimate made by other authorities.

Mr. WILSON. And was given by you only on the urgent insistence of the chairman that you give some idea of how much it might be. It was not a proven reserve figure and was never said to be such.

Mr. TAGGART. May I express the hope that the chairman will continue to insist that it be placed in the record, so we can all take a look at it? It is not an iron-curtain proposition.

Mr. MCCOLLUM. I do not get your question.

Senator ANDERSON. I think we have exhausted all the usefulness there is in that inquiry, really. May we go on to ask some other questions?

Mr. Ball, would you say our present methods of producing oil are the best we can have from the standpoint of conservation?

Mr. BALL. I would say that our present methods are the best we now know from the standpoint of conservation and from the standpoint of getting the maximum oil from our present discoveries. I think we are far from having solved all the problems. Therefore, our technology will improve year by year, as it has in the years gone by, as Dr. Wilson has pointed out.

I think we have no conception of how much we will continue to improve our methods and thereby increase both our conservation and our productivity. We are not getting all of the oil out of the ground that is in the ground. That is a matter of common knowledge. We have not learned how to do it. I do not know that we will ever learn how to get all of it, but that which we are getting has improved decade by decade, as we know now how to get a good deal of oil that we did not formerly get.

As one of our leading thinkers has pointed out, an increase of only 1 percent in the amount that we actually recover adds 1,000,000,000 barrels to our world-wide reserves, and we are increasing by increments much greater than 1 percent as we apply continually improving technologies.

That is part of what I had in mind yesterday in saying there is a finite limit to the amount of any natural resource, but there is no finite limit to man's resourcefulness for either getting out what there is or for replacing what we now use with something better and more abundant, as time goes on. That has been the whole record of history.

Senator ANDERSON. Can I ask you one more question, Mr. Ball?

Are production regulations working fairly effectively?

Mr. BALL. I think they are. I think our conservation laws are working very well.

Senator ANDERSON. Is there very much avoidable waste?

Mr. BALL. At the present time I think there is very little avoidable waste. Very little. That even applies to the States where we do not now have conservation laws. Of course, the outstanding example is the State of Illinois, which has no conservation law.

However, in Illinois today there is very little avoidable waste. There has been tremendous avoidable waste in Illinois for lack of a conservation law, but that time has passed with the passing of the flush production stage of the big fields there.

Wyoming just passed a conservation law, but Wyoming and the operators there have done a pretty good job of it. I think avoidable waste now is very scarce.

Mr. JACOBSEN. Incidentally, Senator Anderson, may I pay a compliment to your own State? New Mexico's conservation law is working excellently. I think you will agree with that.

Mr. BALL. That is one of the model laws.

Senator ANDERSON. We were fortunate in being able to copy from other States.

Mr. JACOBSEN. It is not all in the law, but also in the enforcement, and that is being done very well.

Senator LONG. Speaking of conservation, Mr. Chairman—and this is, of course, a bit out of our line in some respects—I wonder if we are conserving the way we should when we keep building larger automobiles and attempt to produce these new engines that will use higher and higher octane gasoline. Do you have an opinion on that, Mr. Holman? Are we conserving our steel and oil?

Mr. HOLMAN. I do not know much about the question of automobile engines, but as I understand it, they wanted to go to a higher compression ratio largely to save steel, and in some cases it is really less.

Senator LONG. It seems to me, particularly in the face of a possible austerity period for a time, with armament going on, we should try to encourage production of smaller automobiles. My impression is that the public wants them. My dealer tells me it is always easier to get a Buick than a Chevrolet for example, because people are afraid of gasoline rationing, and if we do have that they will not get the mileage out of a Buick.

Mr. HOLMAN. The same principle could apply to higher compression engines. As I understand it, that is a steel-saving device.

Senator LONG. If you do save steel on higher compression engines, would you not lose it on petroleum? In other words, you have to have a higher octane to use that engine, do you not?

Mr. HOLMAN. You have to have a better gasoline, of course, but I do not think it takes any larger quantity.

Mr. WILSON. It would take a little less gasoline, but a better quality and harder to make.

Senator LONG. Would not that require a lot of additional steel in your refining process, and would it not also require that you waste more petroleum in order to have that higher quality of fuel?

Mr. HOLMAN. No. I do not think you would waste any fuel. I think it would probably be a conservation influence as far as fuel is concerned.

Looking at the amount of steel itself, I think it would probably take more steel. You are right about that—because it would take more refining processes, which would end up by taking more steel.

Senator LONG. As far as building a larger automobile, however, you do not necessarily agree?

Mr. HOLMAN. I am personally in favor of a small automobile, but there again it comes to the customers' choice as to what they want.

Senator LONG. Of course, at the present time it looks like the customers would be willing to go for a small automobile, but the automobile companies have not been willing to give them that.

Senator ANDERSON. May I explain to Mr. Taggart the reason why I ended this discussion a moment ago. It seemed to me quite obvious there was no factual or statistical basis for the 120,000,000,000 estimate, and there was no point, I thought, in further discussion of it. Nobody is willing to say he has any set of figures to back it up, and it really has no part in our calculations.

Mr. TAGGART. Then it has no part in this discussion.

Senator ANDERSON. It has no influence on me. I cannot speak for anybody else.

Mr. TAGGART. Thank you, Mr. Chairman. It has less influence on me.

Senator ANDERSON. I think the resources are in there, and I think you can easily develop them; but I am more impressed with the known reserves that the oil companies set up and the known reserves of coal.

Mr. BALL. May I talk to that point a little bit, Mr. Chairman?

Senator ANDERSON. Yes. I may be sorry I opened it up again, but proceed.

Mr. BALL. It is not just opening up the 120,000,000,000 figure. I want to do a lot more than that. I would like to do two or three things. I would like just to make a pass at the slurs in Mr. Cooke's memorandum about undocumented prophecies, and at those implied in Mr. Taggart's question. I would like also to try to answer a question Senator Long asked about where are these undiscovered reserves, which means what is the reason for our faith. We have reasons, and we are not just presenting undocumented guesses in the form of optimistic prophecies with nothing to back them.

The people who tell where to drill for oil are the geologists and geophysicists. They are the people who are entitled to an opinion. They are the people whose opinion is worth having as to what our prospects are for future discoveries. If anyone could answer Senator Long's inquiry as to where are these undiscovered reserves, they would no longer be undiscovered reserves, but would be discovered reserves. So obviously, no one can put his finger on them and say, "Here is an oil field that is going to be discovered, and there is an oil field that is going to be discovered."

What the geologist can do is to examine the explored, unexplored, and partially explored areas of the United States and apply to these the geologic criteria he has developed out of generations of experience, and then say where are the probable areas within which oil will be discovered, and what are the prospects for discoveries there.

A group of geologists may go far wrong in estimating the amount of oil to be discovered in any particular area, but on the over-all average, if they correlate their studies of sedimentary facies and sedimentary areas and sedimentary bodies, they will come out with

a pretty reasonable guess as to the amount of oil we are going to discover.

Senator LONG. You mean, for example, if you take a certain number of salt domes, where you know the salt domes are, or where the seismograph indicates that they are, and if you are finding one out of three when you explore them, the odds are that you would probably continue to keep up that exploration average.

Mr. BALL. That is true, but you must also include the areas where you have not even found your salt domes, or found your structures. Oil is found in great sedimentary basins. The thing you need to know is how much sediment do you have. What is your sedimentary volume, and what is the character of that sedimentary volume? Certain sedimentary basins are highly productive. The Los Angeles basin is an example. Other sedimentary basins are not nearly so productive because of the difference of the character of the sediments.

When you analyze all of those factors you can come out with a pretty good over-all estimate—not in barrels—and I do not think we should think in terms of barrels, but as to prospects of continuing discoveries at increasing rates as needed.

The figure of 120,000,000,000 barrels which happened to be mentioned here yesterday is a figure which was made by one of our most searching and clearest thinking geologists, Dr. L. G. Weeks, of Standard of New Jersey. That is in print, but I do not know where it is, although I can find it for you, Mr. Taggart, and give it to you and to the committee.

Mr. TAGGART. Will you?

Mr. BALL. That is a tangible figure, but is not a figure that is anything more than just an attempt to give an order to magnitude to it. As Mr. McCollum pointed out, in our present geologic thinking it is way too low.

Senator ANDERSON. All I want to say, Mr. Ball, is that I am more impressed with the fact that the oil industry has continued every year to discover more oil than it has utilized than I am with the guess as to how much more there may be. As long as that keeps up, I am going to be encouraged. When that shuts off, I may be worried.

Can you help me on one point?

Mr. BALL. I want to give you some relationships before I am through. Some people have asked for documentation. The nearest we can come to it is this: In 1941 a committee of the American Association of Petroleum Geologists prepared a symposium of possible future oil provinces of the United States and Canada. That [exhibiting a book] is the symposium. In it they reviewed the places where they thought oil might be found in the future. Not the proved provinces or developed provinces, but the possible future oil provinces. Since that time we have discovered something more than 9 billion barrels of oil, and around 50 trillion cubic feet of gas.

Last year the American Association of Petroleum Geologists again prepared a symposium of possible future oil provinces. In the light of the amount of oil and gas that had been discovered in the meanwhile you would think there would be very much less unexplored territory and fewer possible future provinces. This new symposium was prepared not from one man's viewpoint, or two or three, but it was prepared by 17 geological societies; 13 Federal, State, and

Provincial geological surveys or analogous organizations, and more than 100 individuals.

I am going to show it to you just to show you the relative sizes of the two volumes. The 1941 symposium covers 150 pages. The 1950 symposium covers 500 pages. Part of that 500 pages, 24 of the 500, are due to the fact that Mexico is included this time, and it was not included before. So that leaves a comparison of 150 to 475. Really it runs pretty near page by page. I mean, we know over three times as much territory now that looks worth exploring as we did 9 years ago, despite the fact that in the meanwhile we have discovered 9 billion barrels of oil, and 50 trillion cubic feet of gas. It is that increase in territory known to be worth exploring that gives us the confidence so think that our discovery rate can increase. The more we find—let me make this perfectly clear—the more we find, the less there is remaining to be found; but the more we find, the more we learn where to find more. And, that has gone on throughout the history of the industry.

Senator ANDERSON. Do you finally reach a point, however, where the cost of discovery tends to bring in substitute fuels? For example, I read a story about an oil well in Mississippi that they thought they hit last night or the night before, at 20,000 feet or more, into which millions had been put. If that were to be prorated or given a proration by Colonel Thompson, he would probably cut them down to 85 barrels a day, and after they had spent millions of dollars on going to 20,000 feet they would not get very much out of it. Do you not finally get to a point where you would pay a little attention to that?

Mr. BALL. Eventually two things will have to happen. Eventually we will reach the point of diminishing returns, where you do not find enough new oil to pay for your exploratory effort. On the basis of this study made last year, that time is a long way ahead of us.

The curve of discovery with relation to consumption is not a straight-line curve, but fluctuates, as any such curve is bound to do.

People yesterday said that I was talking a different language today than I talked in 1947. There is just enough of an element of truth in that so that I would like to speak to it as a matter of personal privilege. In 1947 we were in one of our sags in that curve. I was uncertain at the time, and all I said was that I was uncertain as to whether we had not reached that point in diminishing returns, or whether we were not approaching it.

Since then the curve has turned sharply up and we can realize today that the sag in the curve was due to wartime restrictions, so that the curve turned up and it has continued to go on up.

There are some catches in this thing, and one of them I would like particularly to mention. We can keep on increasing our rate of discovery for a long time to come if—and here is a very important "if," and it is a matter that has not been mentioned which I would like to bring in right now—we can continue to have the geologists and geophysicists necessary to keep this up; and there is grave danger therein. If we lose too many of those geologists and geophysicists then our discovery rate is going to go down, and it is going to go down seriously enough to affect the defense effort materially.

I have been making some inquiries lately with reference to this matter of technical manpower and from 25 to 50 percent of our geologists are Reserve officers subject to call.

From 0 to 18 percent are draft-liable. They are males between the ages of 18 and 26.

I have gotten the estimates of 15 leading geologists as to what the effect on our rate of discovery would be if the armed services should take half of those men—half of the reservists and half of the men who are liable to draft; that is, geologists and geophysicists only. The estimated decrease in discoveries—and it naturally varies for different companies and different territories—runs as follows: In 5 years if half of the reservists and draft-liable geologists and geophysicists were taken, our discoveries would fall off from 50 to 70 percent. In other words, our number of new discoveries would fall from 50 to 70 percent.

Senator ANDERSON. Do you not think that is a matter we ought to pass on from this committee to the Armed Services Committee?

Mr. BALL. I think it is, sir.

Senator ANDERSON. After all, it is not a primary function we are concerned with here. I think it is something we ought to present specifically to the Armed Services Committee.

I have been trying to recognize Mr. Potter for some time now.

Mr. POTTER. Mr. Chairman, I have been trying to get back on the steel problem, if I could, because the committee has been instructed by the Congress to formulate a national fuel policy to meet the needs of the United States in time of peace and war. So I want to direct your attention to steel.

We are only able to secure at the present time the same quantity in dollars of steel that we purchased last year. That totally disregards any price increase since last year. In the case of my own company, I have not been able to secure one piece of sheet steel since last June.

The coal companies cannot continue to operate on a maintenance and supply basis which does not give them enough steel to go ahead and keep their properties at least in repair. On the other hand, we talked about the oil and gas industry requiring over 11,000,000 tons of steel this coming year, of which—and I will pick out two points—612,000 is for foreign requirements, and over 3,000,000 for natural-gas transmission lines.

Let me show you the vicious circle. One of the products of coal is coke. You could not make steel without coke. Yet the natural-gas industry proposes to use this steel to go into such cities as Troy, N. Y.; Utica, N. Y.; Brooklyn; and Chicago, Ill., to put out of operation coke ovens. The coke manufactured in those plants is used in the production of steel.

Senator LONG. Why do you say those coke ovens would be put out of operation?

Mr. POTTER. They cannot exist without the sale of gas.

Senator LONG. In other words, the coke has to be balanced by their selling the gas. Is that the idea? Is it natural gas, or manufactured gas?

Mr. POTTER. It is manufactured gas. At the same time certificates of necessity are being granted to increase coke oven capacity in other areas.

Senator LONG. Is there an inconsistency in the developing of the coke capacity in other areas?

Mr. POTTER. I would think so. Why should we build a great number of new plants and take present plants out of service? That is highly inconsistent.

Mr. WILSON. In general, as I recall it, the plants that make city gas do not make metallurgical coke, but household coke.

Mr. POTTER. That is not so. In the cases I have mentioned—and those are the plants I am talking of——

Mr. WILSON. They make metallurgical coke?

Mr. POTTER. They make metallurgical coke, and they make foundry coke. They also do make some domestic coke. That is true.

Now, in the case of foreign requirements, there is a very substantial quantity of residual oil being imported into the United States and burned under boilers on the eastern seaboard. It requires more than 50 percent as much steel as we require in the coal industry to maintain these foreign sources.

I do not think that it is at all proper that steel should be sent out of the United States in order to bring boiler fuel back into the United States with coal being cut out and not given operating supplies.

So I think there is definitely before this committee the job of formulating a national fuel policy, and I think we should get back on that. Thank you.

Senator LONG. It seems to me we should develop this question. Does someone have a comment on that?

Mr. HOLMAN. Yes, sir. Regarding requirements for steel, of course a great many of the petroleum operators including nationalities other than Americans have traditionally bought quite a bit of steel in the United States. In the immediate postwar period we took even heavier requirements from the United States.

As operations of the various steel-manufacturing concerns got under way in Europe, we have been buying more and more of our requirements there. We followed the general policy: We sell goods, we buy as much locally as we can, in places where a good many of our foreign operations are purchasing all they can from Europe. Actually today we are importing some steel from Europe for our operations here in the United States.

I think it is important that these foreign operations keep going from a national defense standpoint, as well as the domestic ones, and I think that to the extent they can acquire all kinds of oil-field equipment and refinery equipment and everything else abroad, they should, and that they should naturally come here for the material they cannot get abroad.

Senator LONG. Here is one question that occurs to me on the use of steel. It has not been too well developed, although it was mentioned by Mr. Taggart yesterday. There is a request for more than 3,000,000 tons of steel, as I understand it, for gas transmission pipelines. If the fuel that would be supplied by that gas is presently being made by the coal industry and by fuel-oil deliveries, I would be curious to know the necessity for going ahead at that rate with the program at this time. It would seem possible that steel might be better used, for example, in the development of additional wells, and that sort of thing, rather than in additional pipelines.

Furthermore, there is sometimes the matter of choice. For example, Dr. Wilson, I believe your company has large gas reserves in some areas in and adjacent to my State. There are major industries who would like to locate there to manufacture aluminum and things of that sort, drawing on those same reserves, and negotiating

with you for it. Of course, there is a question as to whether we ought to use the steel to construct a pipeline to the east to use those same reserves for domestic heating, when probably they might be used domestically and industrially for the war effort in those same areas.

I would be curious to know what the situation is on that. I see Mr. Kayser here, who may have an answer in mind.

Mr. KAYSER. Yes. On the question of what pipelines will be built in the year 1951, there are two authorities that have already been set up that have jurisdiction to determine that question. One is the Federal Power Commission, and the second is the Petroleum Administration for Defense on the allocation of steel as it may be related to the national defense.

The Federal Power Commission, of course, has been operating for quite some time, and has the facilities and organization set up to pass upon the convenience and necessity of building any pipeline at any time. Properly that jurisdiction certainly should be exercised, and should continue to be exercised through the defense effort.

As to the distribution of the steel and whether or not a given pipeline should have the steel as against some other pipeline or some other use, that has to be determined by the Petroleum Administration for Defense, and that is the present administration as it exists.

Senator LONG. To answer the question I had in mind, Mr. Kayser, it is the question as to whether any pipelines are really necessary at this immediate time, for example, for the delivery of additional natural gas to the eastern or northern market, which is already being supplied by fuel oil and coal.

Mr. KAYSER. That question, Senator, can only be decided intelligently after hearing all of the evidence on the subject that would be presented to the Federal Power Commission in a certificate of convenience and necessity, and that would be presented to the administration that passes on it.

Senator LONG. I am sure there is a large amount of evidence being presented on both sides of the question before those two bodies.

Mr. KAYSER. You are right, and properly it should be so. Nobody is going to be deprived of anything until he gets his hearing. He might be deprived then, but at least he will feel he has had a run for his money. That is the way it has to be decided. These gentlemen here will have the opportunity to present the facts as to how that steel should be allocated.

Senator LONG. Is that presently being heard before PAD or FPC?

Mr. KAYSER. Both are functioning. The present plan is for both to function; and in my judgment it would be a complete waste to throw away the experience of the Federal Power Commission and not use it to function on these matters now as it has in the past. It did that in the last war, and I think they were successfully handled.

Mr. POTTER. Mr. Chairman, I happened to be Deputy Solid Fuels Administrator in the last war, and there was no opportunity whatsoever by the coal industry even to make any suggestions with respect to the appropriate use of steel in the oil industry, as compared to the coal industry, and I think that same thing is true today. That is why I have come back time and time again to the fact that the Congress sets the policy in this country, and not the individual governmental agencies.

Mr. KAYSER. I am wondering if that is an accurate statement, because I went through the last war myself and handled personally all of the things we had to get priorities on, and I believe I can state it simply and accurately that if you had a project that required steel, you had to make out certain forms and present certain information to the War Production Board. You had to substantiate that with evidence, and they took your claim for priority in consideration not of just your statement, but of the total requirements for steel for all purposes.

So that, if you had a project, or if the coal industry had a project for expanding or increasing production, they had a perfect right to present that matter to the War Production Board. The job of the War Production Board was to weigh all of the various applications for steel, and I was held back for mine because of everyone else's demands, including the coal industry.

Mr. POTTER. That is not true either, sir, because the coal industry, as such, and the Solid Fuels Administration, as such, did not have any opportunity before the Requirements Board to pass on the various phases of that program. Now, it is a matter of public concern and public policy.

Mr. KAYSER. You had the same opportunity to get your priority that I did before the War Production Board.

Mr. HALL. Mr. Chairman, my name is Robert E. Lee Hall. I am counsel for the National Coal Association and I am substituting for Mr. Battle, who was called away on urgent business. I would like to make a few comments, if I may, on Mr. Kayser's statement relative to the jurisdiction of the Federal Power Commission over steel.

I have sat in on many FPC cases. The question of whether steel should properly be used in pipeline construction——

Mr. KAYSER. Excuse me just a moment. I did not make the statement that the Federal Power Commission had any jurisdiction over steel. I did not make that statement.

Mr. HALL. I believe the question was whether steel should be used or not.

Senator LONG. I belive Mr. Kayser's statement was that the question of whether the pipeline should be built was for determination by the Federal Power Commission. Having decided that, the question of whether steel should be allocated to them was up to PAD.

Mr. KAYSER. That is a correct statement of my remarks.

Mr. HALL. I would question your point. The only inquiry the Federal Power Commission would make was whether you had firm commitments for steel pipe or not. I think it is in the public interest to make the inquiry as to whether or not new gas pipeline installation should go into areas already being served by coal and oil.

This is just trading one fuel for another, and it certainly seems an unnecessary waste of steel in order to allocate it for such purposes. It merely is a delicate balance of the question of convenience which was raised before the committee yesterday.

In times such as these, I do not believe a question of convenience should be controlling in allocation of vitally needed steel.

As to the question of transporting steel abroad, I have a few comments on that. I believe it very injudicious to allocate any steel to send abroad. Admiral Biggs, who is sitting in the room now, and

who testified a few moments ago, on June 15, 1949, in testifying before the House Committee on Small Business, stated that the Near East would be rendered untenable—and that is a quote—in the event of a foreign conflict.

If we send steel over there for whatever the good purposes may seem now, it would be lost. It could better be used to develop the coal industry in its need for steel and, gentlemen, even the oil industry in its need for steel.

Any justification for the introduction of foreign oil into this country seems wrong from our standpoint. There is no assurance you can continue to import oil; but to the extent which you do, that 800,000 to 1,000,000 barrels of oil a day, represents the extent to which your productive capacities over here are short of fulfilling your requirements here. I say that because I have yet to attend a hearing in which it has not been asserted by responsible members of the oil industry that the purpose of the foreign oil program is to supplement rather than supplant.

I think that takes a little analysis. So long as you are supplementing, that means they are fulfilling the demands for which you cannot through your own facilities provide the fuel requirements of the Nation. To supplant means oil will be coming in and taking away markets for which you can fulfill the requirements. Therefore, at the present time all of your estimates certainly must be revised by the amount of foreign oil which is being brought in.

I would further like to high light and point out the undependability of foreign oil by this statement on February 7 before the House of Representatives, wherein Representative Dewey Short, the ranking member of the Armed Services Committee, pointed out that 54 of 59 tankers bringing Venezuelan oil to this country were sunk during the last war.

Even in the current hearings in justification for the St. Lawrence seaway project Secretary of Defense Marshall and Secretary of Commerce Sawyer have said that they felt that the St. Lawrence seaway was necessary because they could not guarantee holding open the sea lanes between Labrador and the St. Lawrence, which is by all odds a smaller supply line to contemplate holding open in time of conflict as compared to the Near East or South America, as far as that is concerned.

A word to our friend, Mr. Warren, down there. Growing out of yesterday's statements, I would like to say this: You were with us in 1949 and during part of last year. We were very glad to have such distinguished company. At some future date when you can go our way we will hope to walk with you again. Everybody must do his job in the light of his own self-interest. We do not in any way wish to imply there is anything wrong with following the dictates of your own self-interest, but you persuaded, and your groups persuaded, along with the representations made by the coal industry, the Congress, that is, 40 Senators in the Senate on September 15, 1949, to vote for a restrictive amendment known as the Thomas amendment.

This would have limited the importation of foreign oil to 5 percent of the domestic demand in the preceding years. Apparently the reasons which existed then have since disappeared, for I heard it said time and again by groups represented by you—and we, of course, believe it was true then, and I believe it is true now—that the im-

portation of foreign oil represented a restriction or diminution of your productive capacity.

It is my belief that the extent to which you are now willing to let foreign oil come in represents the amount to which your productive capacity has been restricted. In that sense nine distinguished members of this committee here voted for the Thomas amendment, including the distinguished acting chairman, Senator Anderson, as well as Senator Long, and Senator Ecton, and only two members of the present committee voted against the amendment from the floor to restrict foreign oil imports.

Senator ANDERSON. It just shows what a predominantly sensible committee this is.

Mr. WARREN. Is he through?

Senator ANDERSON. Let him finish.

Mr. HALL. I believe I have gone just about as far as I dare to go at this time.

Senator ANDERSON. There is a great deal of freedom to discuss this. I do not want you just to stop unless you have to.

Senator LONG. Should not this be considered also? If we stop exporting American steel to help American companies develop oil, those foreign governments might see fit to do business with someone else rather than America if America cannot develop their oil for them.

Mr. WILSON. Absolutely. Very true.

Senator LONG. Do you have an opinion on that, Mr. Holman? I know your company has been doing some of that yourselves.

Mr. HOLMAN. We have been producing foreign oil for quite a long while, and we hope to continue to do it. As far as the over-all war effort is concerned, while we must depend upon domestic oil for our basic requirements, I think that certainly during World War I and World War II, and in the present emergency, foreign oil has certainly contributed to the over-all defense effort. I think that as a national policy certain of that should be continued.

I just want to repeat a few figures referred to yesterday. The foreign oil production is around 4,100,000,000 barrels a day. That was for the year 1950. Imports into the United States were 850,000 barrels a day—350,000 was of products, and 500,000 of crude. Exports from the United States during the same period were approximately 300,000 barrels a day, of which 100,000 barrels were crude and 200,000 barrels of products.

The point is that international trade goes back and forth, and I think that as a policy we who have been importers for a long, long time have in general followed the idea of supplementing domestic production with the amount that we needed to meet our consumers' requirements. We thought that that was a wise policy. I do not want to go into the whole import program again. I simply called the attention of the committee yesterday to the point that there is a tremendous amount of material available.

The report I mentioned and the report the gentleman just mentioned I think should be considered as well as all other hearings on this import question. It is a question that seems to me to be a very small part of the particular question which you gentlemen have under consideration now.

Mr. WARREN. In answer to Mr. Hall's statement concerning imports, I want to tell him that our position with respect to imports, that is,

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the association that I represent, has not changed. I wanted to raise two issues on our policy adopted by our association in 1947 in respect to imports, and I would like to have this in the record:

> The Nation's economic welfare and security requires a policy on petroleum importing which will not deter the exploration and development efforts in the domestic industry and which will assure an adequate supply to meet the needs of this Nation.

Since a year ago the demand for petroleum increased considerably, that is, the domestic demand, and right now our exploratory effort and development effort is only limited by the amount of steel which we have available.

We are still of the opinion—and I want to add this—that there was a voluntary restriction on imports by the importing companies, and individually they leveled off to meet this increasing trend. At the present time imports are not injuring the development and exploration in the oil industry, but as far as our basic policy with respect to imports is concerned, it is not changing.

It has been brought out that somebody made the statement yesterday that as long as the independent produced all the oil he could produce, he was happy; but our attitude is one of national concern and public interest, and we do believe that there ought to be excess producing capacity on which Mr. McCollum testified there was around 600,000 barrels a day as a cushion in between peak periods.

I wonder, if I may, Senator, give a well digger's opinion on this matter of reserves, if it will not be too burdensome.

Senator ANDERSON. Go ahead, Mr. Warren.

Mr. WARREN. To supplement some of the remarks by Dr. Wilson, my entire experience in the oil industry for the last 28 years has been in the drilling and production end of it. After all, when we talk about the geologists, of course we realize when you have a hunt you have to have a hunter who has the ability and inspiration to go out and find oil. The wells must be drilled also. No oil could be produced without the wells being drilled, and in the well-drilling industry itself I might say that year after year the technology and ability of the industry to drill deeper and deeper has increased. Eighty percent of the wells drilled in the United States were drilled by independent drilling contractors, which number some nineteen hundred.

The job of drilling wells is a tremendous task. Forty-four thousand wells involves about 160,000,000 feet of hole, and there are some 50,000 people engaged in that end of the industry alone.

I do want to point out a few things that have happened in recent years that have added to the efficiency and the ability to drill deeper, because I think it fits into the program. There has been developed on the Gulf coast a particular bit that has increased the rate of drilling about double. In some places in west Texas, where we have heavyweight drilling facilities, and in your State of New Mexico, where it used to take 6 or 7 months, it has been reduced to 2 or 3 months.

There is drilling research going on now to find new methods of drilling that most companies and a lot of contractors are contributing to.

The only thing I want to say with respect to drilling is on the question that you, Senator Long, brought out about the 20,000 feet of drilling. It is that in my opinion, when the time comes we will have the ability in the industry to do it, and there are improvements

in sight now that will make us far more able to do better tomorrow what we have done today.

In the drilling of wells there is a problem of finding oil while you are drilling. As brought out by Dr. Wilson, we have had these methods of coring and a lot of other methods which have been developed that have increased the industry's ability to find this oil while they are going down. But, even in spite of all of that, in recent years there have been some wells missed that were found later, and our techniques have still got an opportunity to improve along that line.

The other thing, of course, is exploration. It has been brought out that the use of acid treatment and harder bits, and things like that, increases the ability to extract the reserve after it is found. However, the main thing I want to bring out in the development of the oil industry is this multiplicity of effort. It somes from a lot of different directions being followed in free enterprise that is continually expanding its technology, and that has met every new problem that has come up.

I firmly believe we are just at one point on that curve now. As additions exist and continue that will still go on up.

I think that was all I had to add to that.

Senator ANDERSON. We had a question a moment ago about the competitive claims for coal and for oil, and I have a little memorandum here that was handed to me by a representative of a special committee in the House of Representatives. As a former Member of that body, I am sure that it is accurate and I thought I would read it into the record:

> The competitive claims for steel for transportation are ultimately handled by Mr. Harrison's organization, the Defense Production Administration, through a requirements committee on which all claimants sit.
>
> Prior to this claims are screened by a special committee headed by Gen. Philip Fleming (or his successor)—the Under Secretary of Commerce—on which Maritime, PAD, Defense Transport, CAB, Inland Waterways, and others sit. Perhaps Solid Fuels should be there, though presumably Knudsen of DTA claims for coal cars is opposition to Bruce Brown of PAD for gas lines.

I just want to suggest if there is a conflict and coal people are not represented, Mr. Potter, this committee is sympathetic to a suggestion from you and a letter from you that we ought to do something about it, and I am sure we would do something about it and try to make it possible for you to come in there as a claimant and be recognized.

Mr. POTTER. Thank you, sir.

Senator LONG. Might we develop the subject of stockpiling fuels? I do not believe it has been touched on as far as I know, except that I believe some statements were made to the effect that production of oil could be enormously increased if it had to be. I believe you stated that, did you not, Mr. McCollum?

Mr. MCCOLLUM. Yes.

Senator LONG. Can you give us offhand what the present production is and the extent to which it could be immediately increased?

Mr. MCCOLLUM. I have reference to the figures from memory, and I may perhaps correct them later. If I remember correctly, last year the American petroleum industry produced 5,400,000 barrels a day. That is the daily average in the year 1950. At the present time we are producing in the neighborhood of 5,860,000 barrels a

day. I read a moment ago the figures of 600,000 barrels a day excess capacity which General Thompson says can be produced in Texas alone.

There is a committee appointed by the National Petroleum Council making a study of the capacity to produce. The preliminary figures, which are subject to revision, would show that the United States capacity to produce, that is, under the maximum efficient rates, would range somewhere, at the time when the study is finished, between 6,500,000 and 6,700,000 barrels a day.

Senator LONG. That would be almost a 20 percent increase, or an 18 percent increase, possibly. How would that stack up with the refining capacity? It would take additional refineries in order to make that useful, would it not?

Mr. MCCOLLUM. I think Mr. Wilson can perhaps answer that question better than I can, Senator.

Senator LONG. Have you heard the discussion in the last few minutes, Mr. Wilson?

Mr. WILSON. I missed part of it.

Senator LONG. We were discussing the stockpiling problem first to see what the actual production is; and, second, how much it might be expanded. It seems the present production is about 5,820,000 barrels a day, and that it might be expanded to 6,500,000 barrels a day.

Do you believe the refinery capacity of the Nation would make it possible for us to use all of that oil?

Mr. WILSON. The refining capacity of the Nation today is slightly in excess of 7,000,000 barrels a day. To utilize that our industry would, however, require the construction of some transportation facilities, and of a substantial amount of seasonal storage, because we do not at the present time have enough storage to take care of the products we would make by running all year round to make this fuel, even though it might be needed in the winter.

What we have done is to store up fuels. In general, you run a refinery at a higher rate during the late fall and winter period in order to make up for the big demand for fuels which is currently running very high.

As to the question of stockpiling——

Senator LONG. I suppose, to pursue that point just a step further, if you wanted to use the full refinery capacity that would actually involve a waste unless you had the facilities available to store some products that could be used in winter only.

Mr. WILSON. That is right. As to the question of stockpiling, to my mind the one thing I think the military should do along the line of stockpiling is to construct and maintain an amount of storage which for the most part would be empty until our entry into war was made. I say that because if, for example, we had an all-out war that developed tomorrow, we should probably give serious consideration to imposing rationing; but unless we had some place to put those products it would simply mean shutting down the production and the refineries. If we had empty storage, we could save products during the early months of the war before the military would need them, and have them available for military or civilian use later.

Senator LONG. What would you require to have that storage?

Mr. WILSON. It would greatly decrease the severity of such ultimate rationing in case we got refineries damaged and there was no foreign source of oil, and it might be a difficult situation.

Senator LONG. What would you believe the most practical way would be to store these additional quantities that would be produced so as to carry them over? How would you suggest doing it? In steel drums?

Mr. WILSON. Oh, my—no.

Senator LONG. In large steel containers?

Mr. WILSON. In large steel tanks.

Senator LONG. In tank farms and that sort of thing?

Mr. WILSON. That is right; and preferably near the point of consumption, so that you would be storing transportation as well as products.

Senator LONG. That, of course, would require large amounts of steel unless you did it with cement. Is that not right?

Mr. WILSON. That is right; and cement is not satisfactory, at least for the lighter products.

Senator ANDERSON. Are you familiar with the oil storage at Pearl Harbor?

Mr. WILSON. Yes.

Senator ANDERSON. You notice the difference in the way it was done prior to the war, when they had construction under appropriations, and how it was done after we got into the war, when they did not have to ask for appropriations?

Senator LONG. What was the difference?

Senator ANDERSON. The difference is—and I should not try to say—but when it was put in prior to the war, it was very carefully laid along the edge there in the most economical fashion possible; but in the war it was put on big trestles so that you could walk around and see it easily. Cost was no particular item.

Mr. WILSON. Some of it was underground, however, which added a good deal to the cost.

Senator ANDERSON. I think it was a fine job, and very well done; but I just noticed they did a much more attractive job, even though doubly expensive, under the prodding of war.

Senator LONG. Using much more steel also?

Senator ANDERSON. Oh, my. Steel was no object.

Mr. KAYSER. Mr. Chairman, I would like to put in, with your indulgence, just some exact facts on the conservation that is being accomplished in New Mexico under the New Mexico authorities. In the year 1950 there was marketed residue gas used in connection with oil which for a number of years was considered of no value and was burned in flares—there was marketed 77½ billion cubic feet of such gas. That is the equivalent of 13 million barrels of oil.

Senator ANDERSON. Will you also put in there the fact that the New Mexico rate is the lowest rate in the United States?

Mr. KAYSER. No. That is not correct.

Senator ANDERSON. Then the figures produced in the hearing on the natural gas bill were incorrect, because they showed New Mexico was getting less than 2 cents for it, whereas Oklahoma was averaging better than 5½ cents.

Mr. KAYSER. That is not true for the year 1950. In the year 1950 the company with which I am associated paid for this identical gas we are talking about here 5½ cents when it is dirty. That contains anywhere from 300 to 1,000 grains of hydrogen sulfide per 100 cubic feet of gas, which is actually very dirty, and it is only at about 40

to 45 pounds of pressure and has to be raised up to make it marketable to 825 pounds. That is the price that is paid regularly for that gas in New Mexico.

Senator ANDERSON. I think our difficulty was, was it not, that a great deal of the gas was going into the carbon black plant at a very low rate.

Mr. WILSON. Yes.

Mr. KAYSER. Previously the rate has been as low as 2 cents, but that was at a time when there was no market and no way to market that gas, and there was no particular market to take it to. Now it is all being marketed. There is no residue gas, or any gas, for that matter, but in this instance no residue gas produced in connection with oil going to waste in the State of New Mexico, which is quite an accomplishment.

Senator ANDERSON. Yes. A very fine accomplishment.

Mr. KAYSER. In the State of Texas, next to it in the Permian Basin, there were 147½ billion marketed. The two together constituted 225 billion, which is the equivalent of 37 million barrels of oil that is saved.

There again the price is paid for that dirty gas—and it is all dirty and all sour gas, and all has to be treated, and it is all at low pressure—the price paid for that on the average is 5½ cents.

Senator ANDERSON. Is there quite a good deal of waste of gas by the use of burning flares and otherwise over the country?

Mr. KAYSER. There has been over the State of Texas and the State of New Mexico over the past 10 years tremendous waste until transportation facilities were built to market that gas. To have an understanding of why that waste occurred, you have to have a little understanding of what it takes to market it.

It is not possible to market gas, the distance that gas is from market, in small quantities. It is only economical to market it just as it is being marketed, with a 26- and 30-inch pipeline. That is what it takes—a high-pressure, large-diameter pipeline moving a large quantity is what it takes to make it possible. That is being done, so that now in the Permian Basin there is practically no gas being flared into the air that does not necessarily have to be.

You can never market all of it, because some of it is of such a life and such variable load factor and variable duration that you cannot afford to build 1,000 miles of pipeline to market it. However, at the present time all of it that has a life sufficiently long to justify the investment to market it is currently being so marketed. Last year we marketed 616 million cubic feet a day of residue gas. This marketing year we will market 800 million cubic feet of residue gas. That is gas that is otherwise considered a waste. It is true conservation.

Senator LONG. I want to go on with this stockpiling. Do you believe we should actually consider, or is a program actually being recommended for the stockpiling of oil at this time?

Mr. WILSON. Of course, in one sense every barrel of reserve producing capacity is the best way to stockpile oil, and the right way to stockpile crude oil. When you come to products, the stockpiling is possible to a moderate extent, but it is difficult to stockpile most products for storage for more than a couple of years. Outside of certain very special products, like high octane gasoline and aviation lubricating oils—of which I presume the Army is building at least a

satisfactory backlog or inventory of in various parts of the world—I do not believe there is much call for it.

Senator LONG. By and large, stockpiling should be a seasonal proposition, rather than an annual proposition?

Mr. WILSON. We do not consider that stockpiling. We consider that seasonal inventory.

Senator LONG. You had some difficulty with that in Chicago last year, did you not, when there were some barges sunk in that lock there? Was there not great difficulty in getting fuel there?

Mr. WILSON. The repairing of the lock and freezing of the area was the trouble, and it came right on top of the railroad strike. The combination of those things, and some of the coldest weather we have had in 3 years, did give us a little trouble, but it was essentially a transportation problem.

Senator LONG. Of course, the problem of stockpiling coal is not as difficult as that of stockpiling oil, is it, Mr. Taggart?

Mr. TAGGART. Certain coals can be stockpiled.

Senator LONG. Do you believe that there may be some need for stockpiling coal?

Mr. TAGGART. I do not see any necessity for stockpiling coals right at the moment unless those who are better informed on this committee see an immediate necessity for it for defense purposes. Why, with the surplus capacity which we have, I see no need for stockpiling it, right for the moment.

Senator LONG. Barring strikes, or something of that sort?

Mr. TAGGART. Well, on strikes, Senator Long and Mr. Chairman, I think we did not properly set forth yesterday from the standpoint of anthracite the labor record, which we are rather proud of. Since 1924—that is a period of 26 years—we have had general strikes in the anthracite industry that amounted to 77 days. That is 3 days a year. We would rather like to challenge any other industry to point to a record that is similar to that or better. We think that is pretty good.

Senator ANDERSON. That is very good.

Mr. TAGGART. In the matter of stockpiling, if I might make some comment on that, insofar as I have gleaned it from this conversation this morning which has been most enlightening, it appears to me that we are producing now about 6 million barrels of oil a day; that our potential capacity, considering refining and everything, might be an ultimate of 7 million barrels a day. That is balancing the imports and exports.

The statement has been made this morning by Mr. Cooke that during the last war military requirements took 1.3 million barrels per day. The statement has been made by those who appear to know and who speak on a subject of this kind, that an all-out shooting war now might require as much as 3 million barrels a day. Six and three make nine, according to my limited knowledge of mathematics, so it appears to be very important that we have a fuel policy. This is necessary for our preservation as there is the possibility that we have presently a shortage of 2 million barrels a day, which is 33⅓ percent of our present production.

Senator ANDERSON. Thank you. I wonder if I could get one question in that came up in some testimony the other day. I hate to quote someone else on testimony, but it is my understanding the

Texas Railroad Commission member, William Murray, Jr., stated in the Scurry County field oil recovery was as low as 20 percent. In the publication, Major Sources of Energy, it states that the usual maximum recovery by water drive is 75 percent. Occasionally east Texas will reach 85 percent. I am just wondering if there is any explanation on that?

Mr. WARREN. The Scurry County field is a gas reservoir. It has no natural water drive itself. We figure somewhere around 20 to 25 percent of that oil will be recovered on that basis. They are now connecting together pressure maintenance projects, and working on them. They will more than double that recovery.

Does that answer your question? That is the engineer's report.

Senator ANDERSON. Do they not get very heavy pay when they go down in Scurry County? Is not that a very satisfactory area?

Mr. WARREN. Yes. It is a limestone-reef producing area that varies in gross thickness from about 700 feet down to, say, 50 feet. But, it is a large field and one of the best fields this country has had in recent years.

Senator ANDERSON. You do not think a production of only 20 percent is anything to get alarmed about?

Mr. WARREN. I think it is, and I think they are alarmed about it and doing something about it.

Mr. JACOBSEN. They are going to double it by means of this pressure maintenance, which will make it 40 instead of 20 percent.

Mr. WARREN. The engineer's report said with pressure maintenance and gas and water production, which they are working on, over the normal producing procedure, I think these new methods will double the ultimate production.

Senator ANDERSON. As I get it, he says it would do it if they did it, and they are looking at it, but they are not doing it, and they are producing it right along and getting only 20 percent of the oil out.

Mr. WILSON. You are not losing anything yet. That oil is still there and you can start your pressure maintenance 5 years after the opening of the field, assuming it is properly produced. It is not a case where they are opening it up and creating an irrecoverable loss.

Senator ANDERSON. That answers the question.

Mr. WILSON. I may say that is an excellent example of what has been referred to as pencil discoveries of oil. In other words, when you estimate Scurry County, you take the proven reserves of oil that can be recovered by methods now being employed at that field. Therefore, they are figuring on a lower percentage of recovery. A year or two from now, when they undoubtedly will put in whatever proves to be the best means, whether it is pressure maintenance or secondary recovery, that will add substantially to those proven reservess, because then, by definition, it will become oil that can be produced by means which are at the site.

By the time we produce 40 percent, my guess is that secondary reserve technology and others will be improved enough so we will get another 20 percent out of it.

Senator ANDERSON. Would it be agreeable if we recessed at this moment? There are some of us who would like to look at our mail before we start again on the afternoon session. We will reconvene at 2:30 this afternoon.

(Whereupon, at 12:50 p. m. the committee recessed until 2:30 p. m. of the same day.)

AFTERNOON SESSION

(Thereupon the committee reconvened at 2:30 p. m. upon the expiration of the recess.)

The CHAIRMAN. The committee will come to order.

Mr. Bloch, I am advised that you have not had an opportunity to add to the information of the committee. Let us call on you now.

Mr. BLOCH. Thank you, Senator. My name is Ivan Bloch. I am an industrial consultant in Portland, Oreg., primarily engaged in the development of heavy power-using industries.

In this battle of the coal titans on the one hand and the battle of the petroleum and natural-gas titans on the other, I just happen to be a little 5-percenter—and I do not imply what is usually inferred. According to the figures in the monograph, hydroelectric power provides about 5 percent of the total energy consumption in the United States.

I think this percentage belies its importance. For one thing, hydro represents about 31 percent of all kilowatt-hours produced in the United States and about 26 percent of the entire electric power-producing capacity of the United States. If this energy were developed by means of fuel-burning plants, it would require an annual consumption of about 180,000,000 barrels of oil, or of about 58,000,000 tons of coal, or of about 910,000,000,000 cubic feet of 1,000 B. t. u. gas.

Thus the use of inexhaustible hydro is a saving in exhaustible nonrenewable mineral fuels—a situation which will continue so long as the sun's heat evaporates the ocean's water.

It is interesting to note that the hydro development in an area is generally an index of its industrial and economic development. That is to say, that in analyzing the hydro development of other nations of the world, it may be readily observed that the primitive areas have had very small hydro development whereas modern nations have gone extensively into the development of hydroelectric power. With respect to the total existing world hydro capacity of about 65,000,000 kilowatts, the United States itself has developed about 30 percent. Parenthetically, the Soviet Union is reported to have developed only about 2½ percent of the world total.

This is one field in which I am happy to say there is little if any argument as to the reserves in the sense implied in today's and yesterday's discussions. Basically, we know fairly well how much more hydro capacity could be developed in the United States. That potential amount is roughly four times our present output. Of this potential undoubtedly about 75 percent could be considered as economically capable of development according to our modern standards of dam and power-plant design.

The 390 billion kilowatt-hours represented by this potential have been variously estimated as corresponding to the energy value of about 800,000,000 barrels of oil per year or about 240,000,000 tons of coal per year. Most of the potential power is in the Mountain and Pacific States. The Pacific Northwest alone, from which I come, has about 40 percent of the national total. As I will point out a bit later on, this is important because, particularly in our area, we are otherwise fuel-poor in terms of oil and gas, and to some extent in coal.

The value of hydro to the Nation derives from four important characteristics:

1. It is an inexhaustible source of energy which can be considered as releasing other forms of energy for other payroll and wealth-producing activities.

2. Through its comprehensive multiple-purpose development, it provides revenues from its sales which are the financial springboard for necessary flood control, the improvement of navigation, the development and expansion of agricultural production through irrigation, recreation, and domestic water supply. Again, its development multiplies the development of payroll and taxable wealth.

3. And this, in my opinion is perhaps the most important—it is a preferred source of energy for certain types of industries basically essential to our national economy—the so-called electroprocess industries.

4. Finally, in the areas of greatest potential supply, hydro is the primary source of energy.

If I may, Senator, I would like to spend just a few minutes on the relationship of hydro development to electroprocess industry development—those industries in which power is a raw material, and which have become increasingly more important as a base for national industry, and certainly for national security. Among the important industrial materials which can be produced only by means of enormous quantities of low-cost and continuous power are aluminum, magnesium titanium, ferroalloys, copper, zinc, artificial abrasives, chemicals such as chlorine and caustic soda, phosphorus, calcium carbide, hydrogen peroxide, and so forth.

These industries are peculiar in that in their essential make-up they require very large quantities and continuous blocks of low-cost electrical energy. I stress this cost element, because it is the basis of our ability to compete with the production of electroprocess materials of other nations, for example.

These industries have grown at a greater corresponding rate than all of our other industries, particularly in their electric power requirement. For example, the manufacturing industry in the United States from 1939 to 1947 almost doubled its power use, consuming now about half of the total amount of electrical energy consumed for all purposes in the United States. During the same period, the use of power in electroprocess industries just about tripled, representing now about one-fifth of all manufacturing industry kilowatt-hour requirements. Another index of their growth is in employment rates. From 1939 to 1947 manufacturing employment as a whole increased 53 percent. For industries having a power consumption in excess of 40 kilowatt-hours per man-hour, corresponding employment increased about 86 percent.

The future indicates that these industries will become ever more important in our national life. The development of new metals, new chemicals, new processes, heavily depend on the utilization by electroprocess industries of enormous power supplies of the lowest costs. For example, high-temperature corrosion-resistant metallic alloys for gas turbines, for jet engines, for rockets, are as a rule products of the electric furnace and the electrolytic cell. The production of new metals such as titanium is basically and almost entirely dependent upon larger, low-cost power supplies. The same thing applies to many new chem-

icals. Further, the depletion of some of our more basic mineral materials places a premium on ample low-cost power supplies. An example is to be found in a figure which has been quoted that iron-ore production which formerly required about 3 kilowatt-hours per ton may take as much as 75 to 80 kilowatt-hours per ton of taconite concentrates.

The place of hydro among all the other sources of energy about which we have heard is that, first of all, it is complementary; second, it is essential for a basic segment of our industrial structure; third, it is required in some of our fuel-poor regions; and, fourth, it is an essential, revenue-producing element in our national programs of river development.

Two major questions should be raised. One, is hydro being developed rapidly enough to meet national and regional needs. I think the answer is in the negative. The second question is whether or not hydro programs are being carried out in the most economic manner possible—on the basis of reasonably definite annual schedules. There, to, the answer seems to be in the negative.

Speaking as a proponent of hydro development, I have no quarrels whatsoever with other sources of fuels, because I feel that hydro represents, in itself, a very important specialized type of fuel. Its development—even if accelerated as it should be— will continue its energy contribution in roughly the same gradually increasing proportion in relation to other sources of energy.

The CHAIRMAN. Do I gather from your statement the conclusion that the advantage of hydro is to be found particularly in those areas which are deficient in other types of fuel and which do have natural deposits from which these new metals and new chemicals may be developed?

Mr. BLOCH. That is generally true, Senator.

The CHAIRMAN. Then you do not want to leave the inference that if the other fuels were available they could not do in the processing and refinement of these other raw materials, the development of metals, the development of alumina, and the like, what electric power does?

Mr. BLOCH. There is no comparability. In other words, electric power is indispensable in some of these processes. For example, aluminum metal cannot be economically produced except with electric power. It is true that the generation of the power for electro processes may be derived either from gas or coal or oil or hydro, but in the matter of cost, hydro power is by far the most economic. As I pointed out previously, this is important in order to maintain the competitive position of domestically produced materials, vis-à-vis, those being produced in other countries from low-cost hydroelectric power.

The CHAIRMAN. I have heard scientists say that an electric furnace can do what a coking oven will do, so that if there were a deficiency of coking coal, the electric furnace would be the best substitute for a coke oven. Is that right?

Mr. BLOCH. No, I do not think so, Senator, if I may be permitted to say so. It is possible to make coke by means of electrical methods, but basically the most economic way is through the normal coke oven where valuable byproducts such as gas and coal-chemicals can be recovered.

The CHAIRMAN. Yes, but I was speaking of a deficiency of coking coal.

Mr. BLOCH. If you start off with a deficiency of coking coal first, it is going to be pretty difficult to make the coke we need anyway, regardless of whether we have electric furnaces or not.

Dr. WILSON. The Senator may be thinking of the byproducts which we now get from coking coal which can be measured with carbide and acetylene if so desired. That is, a number of them can.

Mr. POTTER. The answer to your question is "Yes," that the electric furnace can displace coke.

The CHAIRMAN. Can displace coke?

Mr. POTTER. That is correct.

Senator LONG. As a matter of fact, some of the best steel in the world is made in Sweden by electroprocess, is it not?

Mr. BLOCH. That is right. The use of electric furnaces can result in a lesser use of coke in the production of certain materials. But carbon in one form or another is still necessary. For example, charcoal may be utilized in the smelting of pig iron in the electric furnace.

The CHAIRMAN. You misunderstood me if you thought I was asking about the production of coke by electricity. I was not. I was asking about the production of other materials which are produced now by the use of coke.

Mr. BLOCH. I misunderstood your question, and the answer is "Yes"—at least in part.

The CHAIRMAN. Do any members of the panel desire to ask Mr. Bloch any questions?

Dr. WILSON. What proportion of our Nation's reserves with recognizable water power would you say have thus far been developed?

Mr. BLOCH. We have developed less than one-fourth of the entire amount available. In other words, about 90 billion kilowatt-hours have now been developed out of a potential total of some 390 billion kilowatt-hours.

Senator LONG. Where are the main sources of hydro power that are left out?

Mr. BLOCH. Mostly in the Mountain and Pacific States. To itemize, we have the Columbia River as the greatest potential power producer, then the Colorado, the Missouri, still a certain amount in the Tennessee, although to a much lesser extent, and the St. Lawrence.

Senator LONG. Do you put the Columbia ahead of the St. Lawrence?

Mr. BLOCH. Yes. Very definitely. As a matter of fact the Columbia River has a potential yet to be tapped of about 33,000,000 kilowatts. The St. Lawrence is much less than that.

Senator LONG. What would you estimate the St. Lawrence to be?

Mr. BLOCH. I can give the data to you. Of a potential total in the United States for the following rivers of 44,000,000 kilowatts, the Columbia has 33,000,000, which is 75 percent; the St. Lawrence, 1.8 millions; Colorado 4.4 millions; Missouri 3.7 million; and the Tennessee 1.1 million.

Senator LONG. In other words, the St. Lawrence is fourth?

Mr. BLOCH. That is correct.

Senator LONG. If you take what has already been developed, that is what could be developed?

Mr. BLOCH. That is right.

Senator LONG. How much power do you already have on the Tennessee?

Mr. BLOCH. 2.3 million kilowatts.

The CHAIRMAN. On page 3 of our document of basic data, table A–1 gives us the annual supply of energy from mineral fuels and water power in the United States from 1889 and 1899 to 1949 in trillions of British thermal units. To me this is one of the most dramatic pieces of information that we have.

It will be observed that in the last column where the grand total of energy supplied from all fuels is revealed, we started out 50 years ago with 7.409 trillion thermal units and there has been a steady growth through the 50-year period.

In 1949 the preliminary figures would indicate that the total production was 31.367 trillion. That is, of course, over a fourfold growth. Apparently during 1947 and 1948, indeed during the war, the total was larger than that.

It would also appear that with the exception of a comparison between anthracite and water power, in which water power is now 1.539 and anthracite 1.085, this is the only instance in which there has been any displacement, the total production of all coal being greater now than it was 50 years ago. In view of this, the question that I should like to address to all the members of the panel is this: Whether, given a continued increase in our population and an expanding economy, there is any reason to believe that any of these fuels is really likely to suffer from the competition of another.

Mr. Bloch rather shakes his head negatively.

Mr. Potter?

Mr. POTTER. I will say "yes." The reason I say "yes" is that it depends on the economics. If there is an artificial economic barrier to promote the growth of one industry as against another, it will affect one competitive fuel as against another.

The CHAIRMAN. Did you say if they are put forth?

Mr. POTTER. That is correct. Let us assume that the Government puts in hydroelectric developments where the Government provided all the funds, no taxes were paid on the electricity produced, then it would obviously make inroads into one of the competitive fuel industries.

That is why I used the word "economic."

The CHAIRMAN. Let us make it specific. We have had a great agitation going on for a period of years for the St. Lawrence seaway. That is stronger now than it ever has been because of the degree to which we have shipped out the ore of the Mesabi Range and because new sources of iron ore have been discovered in Labrador, and the steel industry is very anxious to have an easy method of transportation for the iron ore of Labrador to existing mills.

In the light of that instance, what comment would you like to make?

Mr. POTTER. Mr. Chairman, that is a two-pronged problem. One is transportation. The only comment I could make on that is that we were not able to keep the St. Lawrence open during the last war. We had to rail all our supplies to Nova Scotia.

If we do not do a better job of keeping it open in the future the St. Lawrence will be worthless as a waterway in time of war.

With respect to the generation of electricity, the quantity that can be generated on the St. Lawrence is not very great. If the St. Law-

rence development paid its proportional share of the cost of Government, then I do not see how I personally could object to hydroelectric development on the St. Lawrence. We have no assurance that that will be done.

The CHAIRMAN. Any other comments?

Mr. JACOBSEN. I would like to ask Dr. Potter if he considers that any such economic barrier is in existence at present.

Mr. POTTER. Yes; I do.

Mr. JACOBSEN. Would you mind saying what they are?

Mr. POTTER. We have seen electricity sold out of hydroelectric developments at a lower price than the taxes paid by public utilities.

The CHAIRMAN. At a lower price than the taxes paid?

Mr. POTTER. Than the taxes paid; yes, sir.

Mr. BLOCH. I think there is room for argument there, Senator. I do not know that this is the time for it.

The CHAIRMAN. I do not know of a better time.

Mr. BLOCH. In the allocation of power costs in Federal projects, whatever might be considered otherwise a profit is returned to the Federal Treasury anyway. It seems to me that the same revenue result obtains, therefore, whether or not a particular development is undertaken privately or publicly. Most of the large projects yet to be undertaken have to be under public auspices because of associated benefits which are in the public interest and bear no direct charge.

Mr. POTTER. That is the start of another great, major debate, so I will stop here.

The CHAIRMAN. What are the facts, Mr. Bloch, with respect to the comparative amount of hydroelectric power now produced by Government and by private investment?

Mr. BLOCH. It is relatively small. I can give you the exact figures in just one second.

In 1949, the total generation in the United States was 291 billion kilowatt-hours, of which steam contributed 68 percent or 198 billion kilowatt-hours, hydro roughly 90 billion, or about 31 percent. The publicly operated hydro plants contributed just about half of that amount, in other words, roughly 45 billion kilowatt-hours per year or about 15 percent of the entire United States total. Of this 45 billion kilowatt-hours roughly half is in plants of the Federal Government, the others being of municipalities, cooperatives and other public power bodies. So that the amount generated by the Government is still a small proportion of the total amount.

Mr. COOKE. Do you have the figures of the investment?

Mr. BLOCH. Yes, I have. They are extremely rough because the investment figures have varied very greatly.

The total investment in the Nation's electric power industry in 1949 was slightly over $21 billion. This included generating plant, transmission lines, and all facilities including distribution. The total investment in private utility plant was $17 billion. The Federal investment allocated to power was in the neighborhood of $2.5 billion to $3 billion, with the remainder of about $1.5 billion being mostly of municipalities, cooperatives, and so forth. Of the total investment the private portion is by far the largest.

The CHAIRMAN. We had invited Mr. G. W. Hamilton, consulting engineer of Washington, D. C., to participate in this round table. He was unable to come, but he sent me a letter under date of March 4

with the request that I present it to the record. Inasmuch as it contains only 5½ pages, I think it would be only proper that I should read it into the record:

MY DEAR SENATOR O'MAHONEY: Inasmuch as I cannot be present to participate in the round-table discussions on the development and utilization of our energy resources, to be held on March 7 and 8, I should like to submit my comments by letter.

My professional engineering experience has been in the field of developing and transmitting steam and hydroelectric energy to load centers at least cost to industry and to the public. This objective, to which the efforts of many people have been directed, results in a far greater market for all types of fuel and energy than would occur under higher costs and less efficient use of fuels.

Existing and prospective consumers of energy who require large amounts of it are continually seeking lower cost energy available over long periods of time for their increasing requirements. This must be done to meet competition within the United States and from other countries. Furthermore, associated industries depending upon the products developed by large users of power are encouraged to locate their respective factories closer to these sources of materials. This process has resulted in rapid regional developments such as those built up around Niagara Falls power; in the States of Washington, Oregon, and Tennessee around water power; and in regions like northern Illinois and Indiana, Ohio, and Pennsylvania built around low cost coal.

Canada has been exceedingly alert to secure new industry through development of their low cost water resources. They have aggressively developed to a point of virtual completion practically all the water power in the St. Lawrence Basin that is available to Canada. The resulting industrial area is now aptly called the Golden Triangle, being that section which lies adjacent to and north of New York State.

It is important to recognize that wherever low cost energy is made available, whether its source is water, gas, oil, or coal, the use of all mineral fuels has increased in such areas to a greater extent than would have been the case if abundant, low cost energy had not been readily available. Buffalo—1949 population 620,000—is an example of what I am trying to point out. The cheap energy from water power originally attracted industries which in turn attracted associated industries until the original source of energy was absorbed to the extent that a number of large coal-burning steam stations had to be built to supply the expanding market with power. And along with the increase in use of electric energy came an increase in use of coal, oil, and gas for related industries and civic requirements.

Other and older cities, such as Albany—1949 population 142,000—have been strategically located with respect to transportation, market, skilled labor supply, and New York's financial resources, but because of lack of large blocks of low cost energy have failed to fulfill their early promise of industrial development.

The United States has to face not only the question of diminishing sources of energy but the question of rising cost of producing energy and the increasing investment necessary to develop and deliver this energy. Not only the abundance of energy sources but the low cost of that energy has been responsible for the large use of fuel in the United States. Witness the fantastically large power- and energy-consuming developments now taking place in the gas fields of the Southwest, where energy from gas now costs less than in other areas of the United States except from hydro projects such as in the Columbia River Basin, the St. Lawrence Basin in Canada, and at Niagara.

It will only be through future low-cost fuel and hydro power that the electrochemical and metallurgical industries can continue to operate in the United States in competition with lower-cost producers of other countries. This will also hold true in the production of new materials, titanium, for example, now getting under way in Canada. Our position in the United States with respect to additional reduction of imported ores will decline if low-cost power is not available.

We are in the unfortunate position of having but a relatively small amount of low-cost firm hydroelectric energy still undeveloped in terms of our annual growth of 8,000,000 kilowatts. Furthermore, longer periods of time will be necessary to bring each large, presently undeveloped hydroelectric project into production. Now that we are preparing for defense, we find that it has not been to the interest of the United States that the opportunity was neglected in peacetime to develop at an accelerated rate what hydroelectric power was available.

Stocks of critical defense materials, such as aluminum, are not now available. Manufacturing space to produce power equipment as well as materials for defense and our national economy is absorbed to the extent that normal early delivery of energy equipment and transmission material is no longer possible. Through accelerated amortization the taxpayers will have to pay for a large portion of the cost of power facilities now being installed for defense purposes, and those power developments will become the property of private industry. From the point of fuel conservation alone, this lack of foresight is particularly unfortunate in areas where there was already a shortage of power before the present defense emergency, and where efforts to bring about greater development of this continually renewable resource met with only partial success.

It is comforting to note that major power-supply companies are installing large, high-pressure, high-temperature steam turbines with efficiencies approaching 9,400 British thermal units per kilowatt-hour of electrical energy. It is discouraging to note that industry, aluminum for example, is installing large numbers of power units requiring 20 percent more gas fuel than would be necessary if large central stations were employed. Small units are ideal for small loads where their use should be encouraged. But they have but little universal application or salvage value.

It is comforting to note that fuel burning and water-power plants are now being used to a greater extent in conjunction with each other, resulting in the conversion to useful energy of otherwise wasted water, and in greater and more efficient use of fuels, particularly in such areas where the cost of mineral fuel used alone would limit not only the total amount of fuel used but industrial expansion as well.

An effective national program for the conservation and development of fuel and energy should, I believe, include the following:

1. Large, regional plants should be built that will develop electric energy with the minimum absorption of our exhaustible resources and the lowest cost to the consumers of such energy, such plants to be located in the coal, gas, oil, or water-power areas best suited to the energy resources of that area.

In areas where energy resources are not indigenous, the selection of locations should be such as to provide energy at least cost to the greatest number of consumers.

To conserve our fuels, an example of what not to continue to do has already been given in reference to the gas fields of the Southwest. In New England, electric energy is being developed through a large number of small plants, whereas a material fuel saving could be made if energy were to be supplied through a few major plants containing the highest-efficiency power units. An example of what to do is taking place in West Virginia, where a 1,000,000-kilowatt steam plant has been started at the mouth of a coal mine adjacent to ample condensing water; and in southern Illinois, where a 500,000-kilowatt plant similarly located is under way.

2. Large energy-consuming areas should be interconnected in a major way, thus permitting greater and more widespread use of the most efficient power plants, such as the Pittsburgh-New York, Wisconsin-Illinois, Oregon-California, and Oregon-Idaho areas.

3. Liquid and gas fuel should be fully used and developed. In the interest of conserving such fuels as are not now being used most economically, when future scarcities occur and the fuels can be utilized for services to which they are better suited, it is suggested that provision be made for recapture of these fuels by the owners on condition that the recaptured fuels can be reasonably replaced by some other source of energy.

4. Our future, major, low-cost energy supply will be coal. Its development should be encouraged, particularly in the direction which will result in the delivery of energy at least cost to the consumer.

5. Construction of hydroelectric plants capable of developing firm energy at low cost should be encouraged under an accelerated and definite annual national program and have the cooperation of all producers of fuel.

6. The United States must make its low-cost energy resources available to all areas in the United States, so that it can continue to maintain its industrial position which results in our high level of living.

Various industries are now moving along on the program just outlined on their own behalf. However, the United States has been without a national program. The benefits of establishing a national policy covering the development and utilization of our energy resources will accrue to all of us.

Respectfully submitted.

G. W. HAMILTON.

May I make this comment: that in summary this seems to be a statement that the various fuels can work together to the mutual benefit of all, on the whole, and that there ought to be a national policy by which this copperative development of coal, petroleum, gas, and water power should be encouraged and stimulated.

Is there any comment upon this statement?

(No response.)

The CHAIRMAN. Gas was mentioned, Mr. Kayser.

Mr. KAYSER. I have no comment except that of course the presence in the Southwest of tremendous reserves of gas has had a very strong effect on the development of industry in the Southwest. The greater part of the chemical industry in the United States has been located along the Gulf of Mexico. With water transportation and a reasonable fuel cost, it is obvious that that would result. That is normal competition in effect.

The extent to which—and I could not tell from the reading of the statement—the extent to which it may imply Government investment of capital in large generating plants, it seems to me, is stepping over the line into socialism. We might as well call it what we think it is.

The CHAIRMAN. There is no statement of that kind in the letter, but the question arose in my mind also, I will say, Mr. Kayser, as to whether if Mr. Hamilton were here a question would bring forth any such response.

Mr. KAYSER. So far as I am concerned, I do not think we need, and I do not think we get value out of subsidized power plants. I think we are able to stand on our own feet, and I think that normal development will bring about the results that are needed without subsidizing power plants. That is my own individual opinion about it. The building of a power plant at the mouth of a mine so as to get rid of wasteful transportation where the electricity can be transmitted economically to the spot where it can be consumed seems to me to be an excellent idea, and there is nothing new about it. There are plenty of plants in Texas built the same way right in the gas fields. In fact we are supplying one right now.

The CHAIRMAN. The use of the word "subsidy" may be just a little bit too broad. I suppose there has never been a time in the history of the development of our country that the Government has not undertaken to provide incentives to promote development. These incentives could be called subsidization and they might have been called socialism, too.

A notable example, of course, is the fact that during the Civil War, in order to provide the incentive for the building of a railroad across the continent, the Congress gave away a tremendous amount of public land to aid the railroads. That was a subsidy from one point of view. It was an incentive from another point of view. It all depends on whether you are on the receiving end or not whether you call it a subsidy or an incentive.

Mr. KAYSER. I am talking about the Government entering into the power business or any other business in which it has the effect of putting the business under the control of the Government instead of leaving it to free competition.

The CHAIRMAN. What you are talking about then is the entry of the Government as a government per se into the production, development, and distribution of a competitive source of energy.

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Mr. KAYSER. That is what I think, or into any such arrangement as would constitute the control of it by Government, so that it would not be open, free competition.

The CHAIRMAN. Let us ask Mr. Bloch to comment upon the growth of public power in the United States. Has that resulted in preventing the growth of private power, or have they both gone on together?

Mr. BLOCH. I think the record—and this is one figure I do not have, Mr. Kayser—has shown that the development of public power in the Tennessee Valley, for example, or in the Pacific Northwest, has resulted in a tremendous increase in the business of the private utilities. I am more familiar with the Northwest than I am with the other parts of the country, and I might say to you that the officials of the private utilities in the Pacific Northwest are eager proponents of additional dam construction on the Columbia River and the development of power as well as of the regional transmission system of the Federal Government. They at first opposed this program. They have now found it to be extremely helpful in the development of their own business.

I might also add that they are working along with the Federal Government in an amazing manner. They are by no means in complete agreement, but at the moment, for example, two of the largest Pacific Northwest private utilities are in the process of building their own hydro power plants. They will tie their plants into the over-all Federal network and thereby get benefits, which on an isolated plant basis, they would be unable to obtain. Their plants with their particular production characteristics by themselves would be less profitable than when merged into the over-all Northwest power pool.

I might say this: The principle of lowering costs due perhaps to this type of competition has resulted in an enormous increase of unit consumption and a resulting increase in net profits.

Mr. JACOBSEN. May I ask a question: In the cases you referred to, I suppose the local utility companies then buy the power wholesale from the Government?

Mr. BLOCH. That is correct. In the Pacific Northwest—and in the Tennessee Valley Authority area and elsewhere as well—the Federal Government is not in the distribution business. It acts as a wholesale agency. As Senator O'Mahoney knows very well, there have been severe questions as to whether the Government should go beyond the generators to the transmission system, or whether it should stop at the generator bus bars.

In the Northwest I think there is no question as to the answer. The principle of taking federally generated hydroelectric power close to major centers of consumption has been sound.

Mr. POTTER. Mr. Chairman, with respect to the memorandum which you have just read, referring to primarily the Niagara frontier and the St. Lawrence area, it is true that there is quite a bit of hydro development in that area.

I think the major objection to any of those problems comes about solely from economics. You will find that the Canadian Government, through its Ontario Hydro Commission, actively engages in public power and that over a period of years power demands have substantially increased to the point where two steam plants are now being built in Ontario, and the whole thing that people in the coal industry look to as far as competition is concerned is this: If the United States

enters into that agreement, will it handle it the same way as Canada does—make it pay its own way or will it be subsidized? That is the economic question involved.

There is not the question of whether it should be done or should not be done. It is how you are going to do it.

The CHAIRMAN. Of course those are all problems that are well within the jurisdiction of this committee in this study.

Mr. BLOCH. Senator, on that point of subsidy, I think there is just one nail that ought to be hammered in a little further. That is, in the case of the multiple-purpose projects in the West with which you are infinitely more familiar than I, the power revenue component is the financial springboard for the repayment of the entire investment in dams and other facilities including those for irrigation, with some allowances, for example, on navigation and flood control, which are traditional.

Mr. POTTER. And the source of the traditional arguments, so far as economics are concerned?

Mr. BLOCH. That is correct.

The CHAIRMAN. Any other comment on this phase of the matter?

Mr. POTTER. Just to be sure that the record is straight: A while ago you asked the question about the replacement of coke in electric furnaces.

The CHAIRMAN. Yes.

Mr. POTTER. That is true in some cases. However, in these cases it reached astronomical figures of cost. Your question was solely: "Can you do it physically?"—I presume, and not "economically."

The CHAIRMAN. My question was an "iffy" question based upon the diminution of our supply of coking coal. For example, I am acutely conscious of the fact that we have no coking coal in the State of Wyoming. We have a lot of very good coal there, but none of it apparently cokes.

Therefore, the comparatively great deposit of iron ore in and around the town of Guernsey has not been capable of development in Wyoming. It is transported down to Pueblo, Colo., where, by reason of the proximity coking coal, the C. F. & I. plant was established and has prospered.

Mr. POTTER. You see the point there is that if it is the reduction of the iron ore into the metal, then the cost is practically astronomical. If it is the displacement of the open hearth with the furnace, then it almost gets into the economic class.

So I wanted to point out why economics are involved.

The CHAIRMAN. I am glad you pointed that out.

Mr. BLOCH. To make it also clear as a matter of fact, the utilization of electric power and electroprocesses create a direct market for carbonaceous materials. In the aluminum industry, the production of 1 ton of aluminum metal requires a half ton, mainly of petroleum coke.

The CHAIRMAN. When Senator Long left the room to go to his cotton hearing, he expressed the hope that he would be back before we had concluded, but in any event he asked me to raise the question of synthetic liquid fuels. I assume that means that while he was here this morning the subject was not very much discussed.

Let me read, as an introduction to this, from the summary of the annual report of the Secretary of the Interior on synthetic liquid fuels submitted this year. It is the report for 1950. I find two very

significant and perhaps provocative statements here. The first is this, under the heading of Oil Shale:

> The steel required for oil shale mines and plants, as well as the capital investment, appears to have less than now required by the petroleum industry for each barrel-day of added capacity.

The other sentence is this:

> The studies of the last 2 years, however, have brought out one point of major importance in the present emergency: that the amount of steel required for initial construction per barrel-day of gasoline is about the same for coal hydrogenation as it is for petroleum.
>
> Also, if the coal hydrogenation plant is used for 20 years, the actual amount of steel consumed per barrel of product is less than that required for petroleum.
>
> These facts may appear surprising at first glance, but is must be remembered that the oil industry estimates its steel requirements for 1951 at approximately 10 percent of the steel productive capacity of the United States.

Dr. WILSON. Mr. Chairman, with regard to the matter of synthetic fuel, I would like in the first place to make clear something that probably was not clear in the rough-and-tumble exchange that we have had in discussing that. I think everyone in the oil industry recognizes that synthetic fuels from coal or oil shale or both are likely to be our ultimate reliance at some future period. Just how distant it is we do not know.

That is the reason why the industry spent a great deal of money on research and development on that type of process. We want to know about it and we want to be ready. We have not the slightest objection to anyone who thinks it is competitive today taking his own money in building it. We have done this research and development because we wanted to be well informed on it, and we do not think it is competitive.

We do object to taking Government funds or subsidizing construction of something which we do not think is economic at the present time. What I have said about not even needing to give serious consideration to the construction of synthetic plants until we get a 25- or 35-percent expansion plus rationing as I mentioned in your absence this morning, was simply because that is expansion which we have made or can make almost without the investment of new steel, except a moderate amount for storage.

When you come to the ground-up construction of synthetic plants and the provisions for getting the raw materials to them and provisions for getting them to market, the comparative figures are not in the best shape at the moment.

What the Secretary says, that it appears to be less, is based on some figures which the Bureau of Mines got out for the cost of synthetic plants. The head of the Bureau of Mines and Secretary Chapman have requested the petroleum industry to supply a panel of experts to review those figures and see what their opinion of them is. That committee has been at work for several months and is expected to report in about 2 months from now.

At the same time, the Secretary has asked the National Petroleum Council to appoint a committee of the petroleum industry, of which I happen to be chairman, on a million-barrel further expansion of the industry, and a substantial part of that million barrels is for purposes of comparison being made up on the basis of starting everything from the ground up—discovering the oil, drilling the wells, building the refineries—in order that we may have some reliable figure on steel requirements, capital requirements, labor requirements for the ground-

up petroleum development, to compare with the firmer figures that we should soon have for the synthetic fuel development.

But that comes into the picture, as I say, after we have made the major expansion that we can, largely with present facilities.

The CHAIRMAN. Senator Long, I opened up the synthetic question just as you were coming into the room.

Senator LONG. I would be curious to know just how much research has been done on the synthetic problem to convert coal into synthetic gasoline or petroleum by the coal industry.

Do you know anything about that, Mr. Taggart, as to how much research has been done by the coal people?

Mr. TAGGART. Except for that which has been done by the Pittsburgh Consolidation Coal Co. in conjunction with the Standard Oil Co., by private capital very little. The gasification of the finer sizes of anthracite has been determined to be practical, but it has not developed to the point to which we think it should.

There are certain developments going on, as I understand it, in Morgantown, W. Va., by the Department of the Interior, in Louisiana, Missouri——

The CHAIRMAN. The Morgantown plant, Mr. Taggart, is really a laboratory on the campus of the university town there. The Louisiana, Mo. plant is being operated by the Bureau of Mines. It was an ammonia plant constructed by Defense Plant Corporation during the war for the Army and is now being used to liquefy coal.

Mr. TAGGART. Some work along that line, I understand, is being done in Brownsville, Tex. I am not a technician and I am not competent to answer your question, but I should say that the surface has just been scratched.

Dr. WILSON. The Brownsville plant is for converting natural gas, not coal or oil, into liquid fuel, and that is a private industrial venture.

Mr. TAGGART. As I understand it, if you had the gas, regardless of where it comes from, can you not convert it into a liquid fuel through the Fischer-Tropsch method?

Dr. WILSON. That is correct. You can make what they call the synthesis gas—that is a mixture of carbon monoxide and hydrogen from either natural gas or coal—and having carried it that far the last step in the process is very much the same.

Mr. TAGGART. And those interested in synthetics in this country are not satisfied with the process as it was developed perhaps in Germany and so on, and think it must be improved upon? That would be applicable to synthesis gas as well as the natural gas. Regardless of where you do it, those are the things that are going on today, are they not, Dr. Wilson?

Dr. WILSON. Yes. The process has been tremendously improved since the days of Germany, particularly with regard to the quality of the gasoline. The German gasoline was a very bad type of gasoline. By changing the operating conditions the quality of the gasoline has been greatly improved and by applying American engineering the scale of operations per unit has been multiplied some twenty fold, I believe, so that we do have a process here which might later be applied to coal.

I may say, in answer to your implied question: I do not have exact figures but from what I know, and not counting the commercial expenditure of some $40,000,000 at Brownsville, but simply counting

what the oil industry has spent on development of synthetic fuels from various different sources, I should say that it has undoubtedly averaged $2,000,000 or $3,000,000 a year for the last several years.

Senator LONG. It is my understanding that almost every major oil company has been making a major expenditure annually on developing synthetic fuels from coal for one thing.

Dr. WILSON. From coal, oil shale, and natural gas, all three, yes.

Mr. HOLMAN. We studied that problem very extensively, Senator, over quite a long period of time. We are very much interested in it because in the final analysis I might say that we are peddlers of liquid energy. We want to live up to the obligation of continuing to deliver liquid energy. The problem is largely one of finding out which is the best source.

We have worked on synthesizing liquids from solids. We are going to continue to work on it. I think we have made great strides in improving the techniques, and I think in the future that we will make more strides. And I think all sections of the energy industry should follow that practice because we do not want, as a nation, ever to get caught short on liquid energy.

The CHAIRMAN. You have found the Bureau of Mines demonstration plants helpful, have you not?

Mr. HOLMAN. Yes, we have cooperated with the Bureau of Mines. The petroleum industry as a whole has cooperated with the Bureau of Mines.

Senator LONG. How about the gasification of coal? Have you worked on that as well?

Mr. HOLMAN. The Pittsburgh Consolidation Coal Co. and we have worked jointly on the possibilities of that. I am not familiar with all the details of it, but technically there is no question as to what can be done. It is just largely a question of economics.

The CHAIRMAN. According to the Bureau of Mines we are pretty close to the economic line now. In other words, by the oil shale mining devices that are used there with huge machines, liquid fuel is being made from shale at a rather low price, I am told. I have not examined this latest report as yet.

Dr. WILSON. Substantially higher than our present costs from petroleum, however, if you take all costs into account.

I may say that the Bureau of Mines has done a particularly fine job in determining more accurately the cost of mining shale and developing improved large-scale methods of mining shale so that one of the big unknown factors in that has been largely eliminated.

The CHAIRMAN. How close are we, then, to the investment of private capital in the development of coal liquefication plants?

Dr. WILSON. I would say that if gasoline and other products were 3 cents a gallon higher than they are now, you might give serious consideration, but of course 3 cents a gallon is $1.25 a barrel, and I am afraid it will be quite a time before crude oil increases that much. By that time the labor cost, in particular, of mining coal or oil shale may go up to raise the differential again. But it is a substantial distance away at the present time according to the best of our figures. We can answer that whole question a great deal more accurately after these two studies that I referred to are completed.

The CHAIRMAN. What are these studies, precisely?

Dr. WILSON. The Bureau of Mines, I believe, through Secretary Chapman, asked the petroleum industry to set up a panel of experts to review their cost figures and their steel requirements figures, and that committee, under the chairmanship of Mr. Rogers of the Texas Co., with technical men supplied from a number of companies, has been hard at work for several months.

The other committee is the million-barrel expansion committee for the petroleum industry, which has started to work only about 3 weeks ago. That is a committee of the National Petroleum Council of which I am chairman.

The CHAIRMAN. What is the purpose of that?

Mr. WILSON. That is to determine how much it would cost in money, steel, and manpower, to expand our petroleum-producing and refining capacity by a million barrels a day.

The CHAIRMAN. That is purely a research program on the part of the petroleum industry for the expansion of the privately owned and operated petroleum industry?

Dr. WILSON. Correct.

The CHAIRMAN. It has nothing to do with the synthetic fuel demonstration plants of the Government?

Dr. WILSON. That is right.

The CHAIRMAN. The other committee is merely auditing the cost figures of the Bureau of Mines on its present experiments?

Dr. WILSON. Not merely cost, but steel and labor requirements as well.

Senator LONG. Mr. Wilson, are you of the opinion that coal can be both liquefied and gasified?

Dr. WILSON. There is no question but that it can be, and of course to some extent it is liquefied in ordinary coking distillation, but the yield of liquid is very small. There is no question about the technical feasibility of both processes.

Senator LONG. Then as far as worrying about exhausting our petroleum, if that day ever comes, we would still be able to have a gasoline tank on the rear of the automobile, I take it?

Dr. WILSON. No question about that. That is why Mr. Holman says, being peddlers of liquid fuel, we feel we have to stay in business and use our distribution systems for liquid fuel and supply the people who need liquid fuel. We just want to make it from whatever is cheapest at the time.

The CHAIRMAN. This million-barrel study has to do with the domestic United States?

Dr. WILSON. No. Western Hemisphere.

The CHAIRMAN. Western Hemisphere?

Dr. WILSON. It includes Canada and Venezuela, as well as the United States.

The CHAIRMAN. That is what I wanted to find out. The new reserves in Canada are very substantial, are they not?

Dr. WILSON. So I understand.

Mr. JACOBSEN. They have been estimated variously from a billion to 1½ billion. My own guess is that as it stands now probably 1½ billion barrels might be reasonable.

Mr. BALL. That is, proved reserves?

Mr. JACOBSEN. Oh, yes.

The CHAIRMAN. What is the latest Venezuela figure?

Mr. HOLMAN. I am under the impression about 7 or 8 billion. Something like that.

Mr. JACOBSEN. Eight, I think.

The CHAIRMAN. What is the latest from Mexico?

Mr. JACOBSEN. Not very high, but I do not remember it exactly. They have not done much wildcatting or successful development down there for a good many years.

Dr. WILSON. The potential may be high, but the proven reserves are not.

Senator LONG. What is your attitude on the possibilities of additional competition of gas with natural gas from gasified coal?

Mr. KAYSER. We think just exactly as has been expressed by Mr. Holman and Dr. Wilson: That we have a very large investment in transmission lines which cannot earn any money except by having gas to go through it.

What we want to do and what we propose to do is to keep up with the developments and as the reserves of natural gas are exhausted we certainly expect to put through these pipelines the synthetic gas.

I have here a talk that I had occasion to make in which we reviewed up to that date the work that had been done in Germany, of making 570 B. t. u. gas in large quantities out of coal for their war machine, and the statement of the engineer that that could be stepped up to 900 B. t. u. gas without too much expense.

The technique to do it and bring down the cost could certainly be developed, but would not be developed until you had the demand for that type of gas and would do it on a large scale. The volume in which you make it is going to determine the unit cost, and that we expect to do—I am speaking now for the industry, and I am speaking for my own company—when we see the exhaustion of the natural reserves occurring.

I would like to say one thing in that connection: That the natural gas business has been financed on the most reasonable and on a very sound basis in that all of its financial arrangements are based upon amortizing the entire cost from known natural gas reserves, so that when those are exhausted it will be in the financial position to make the necessary additional investment in plants and acquisition of coal reserves if necessary, to supply its raw material for its transportation through the lines which have already been amortized.

Dr. WILSON. There is another respect in which the work being done at Brownsville and in our laboratories on synthesis, particularly at Brownsville, will benefit the conversion of coal into either high B. t. u. gas or liquid fuel, and that is the cheap oxygen plant design, if it works out as well as hoped, is one of the most important tools in making the very high B. t. u. gas from coal.

Mr. KAYSER. No question about it.

Mr. JACOBSEN. Mr. Chairman, you asked about Mexico a moment ago. It is in here at 850,000,000 barrels.

The CHAIRMAN. From what are you reading? From our book?

Mr. JACOBSEN. Yes.

Mr. TAGGART. To get the additional million barrels why do we consider Venezuela if there are reserves in this country?

Dr. WILSON. We do not have to consider it. We were asked to consider all reasonably probable Western Hemisphere sources and we

are complying with the request of the Oil and Gas Division of the Department of Interior.

The CHAIRMAN. That was a recent request?

Dr. WILSON. Yes, sir.

The CHAIRMAN. Possibly in connection with the emergency?

Mr. JACOBSEN. It was, definitely. The letter from Mr. Stewart said so. In connection with the emergency and in case of an all-out war we might need more and, therefore, the million barrels extra.

Senator LONG. What is your company doing, Mr. McCollum, in developing techniques for the use of coal and oil in producing either petroleum, gasoline, or gas?

Mr. MCCOLLUM. We are spending money on research every day to try to find means of extracting liquids from oil shales and for the gasification and liquefication of coal. I sometimes accuse our research boys of trying to get another fuel to try to run us out of our present business, but fundamentally it is longer range than that. We want aggressive, active technology so that when and if we need these other fuels we can secure them from other sources. It would appear on short range that we are trying to run ourselves out of business.

I suppose every company is carrying out development and research in those fields. I would just like to know for my own information—I know a little about the oil industry and nothing about the coal industry—to what extent similar work is going on in the coal industry to expand the uses of coal by research and studies on gasification and liquefication of coal other than the one I think you mentioned being done by Standard Oil of New Jersey.

Mr. TAGGART. The main thing that is being done is the improvement in burning equipment, and also quite substantial expenditures are being made, considering the net income of the industry, on gasification and along other lines. That is to keep ourselves in business, you understand. I rather think maybe that in view of the long research and the short life that your fuel has, that maybe this research that you are doing too is likewise because of the exhaustibility of your minerals, and that you are doing it for the purpose of keeping yourselves in business.

Mr. HOLMAN. That is correct.

Mr. TAGGART. That is because it is in short supply at the present time with reference to the emergencies that might develop. That was developed, Mr. Chairman, this morning: that their potential now, if supplemented, is 7 million barrels a day, but that the requirements may be as much as 9 million in the event of an all-out war, and also we must realize that the supplementary increase of a million barrels a day is obtained only by taking in Venezuela, and by taking in Canada, and the entirety of the Western Hemisphere.

Now I read in the paper last night—maybe I should not pay attention to anything that I read—that we had a buying strike——

The CHAIRMAN. Well, do not believe all that you read in the papers.

Mr. TAGGART. A buying strike in this country with reference to tin, that we were not going to buy any more tin at the present price from Great Britain and from Holland and from Belgium, all supposed to be allies of our own, because of the price having increased 150 percent since Korea.

Now, then, what dependability have we that these prices—3 cents a gallon was mentioned—what dependability have we that Venezuela or Canada might not increase the price of their commodity as much as 3 cents a gallon? What assurance have we of these things?

Mr. JACOBSEN. The oil that is being developed in Venezuela, and to quite some extent in Canada but more in Venezuela, is being developed by American companies.

Mr. TAGGART. I understand that.

Mr. JACOBSEN. We are not buying the oil from Venezuela, so that Venezuela cannot increase the price of the oil.

Mr. TAGGART. You bought it from Saudi Arabia and they did increase the price of the oil so I understood yesterday.

Mr. JACOBSEN. They did not increase the price of the oil. They increased the royalty to the government which will of course increase the over-all cost of producing oil.

Mr. TAGGART. What is the difference between what I said and what you said?

Mr. JACOBSEN. It has not increased the price of oil to any extent that would demand a higher price in the markets of the United States.

The CHAIRMAN. In other words, the profits of the companies in Saudi Arabia are so large that they can afford to pay more without increasing the price to the consumers.

Mr. JACOBSEN. It is a characteristic of the oil industry that it always absorbs all the costs it can and never passes them on to the public. I agree with you, Senator.

Mr. TAGGART. In Mexico—have we any comment to make on Mexico? I read something about that in the paper, too, some years ago.

Senator LONG. Apparently the oil companies did a very philanthropic thing in Mexico. They went on and developed it and then the Mexican Government chased them out. That is about the size of it.

Mr. TAGGART. If it happened there, could it happen elsewhere?

Senator LONG. Someone else could answer that question. I would assume it could happen.

Mr. MCCOLLUM. It could happen here, could it not, Mr. Taggart?

Mr. TAGGART. I do not think so.

Mr. MCCOLLUM. It happened in England.

Mr. TAGGART. I do not think we are going to get into a socialistic state. I certainly am not advocating it.

Senator LONG. Is not the strongest thing in favor of American development of these underdeveloped countries, particularly of oil in Saudi Arabia and Iran and Iraq, the fact that those people cannot do it for themselves?

They do not have the know-how, the technical skill, the steel, the materials. So even if they tried they probably could not do as well for themselves as they could by inviting American management to come in and do the job for them on a partnership basis.

Mr. HOLMAN. Senator, I think it goes a little further than that. Also, it does not do any good, certainly, to have an undeveloped resource in a certain place when you have to deliver products to the consumer at some other place. To the extent that American business can participate in those developments it seems to me it is an undertaking that is worth while to everybody.

Senator LONG. If American business goes in, American business will help them to merchandise their product. There are not enough automobiles in Saudi Arabia to utilize that oil if they had it.

Mr. POTTER. I wonder if anybody could tell me the duty on Canadian oil into the United States at the present time?

Dr. WILSON. Yes; 21 cents a barrel, I believe.

The CHAIRMAN. We have all heard it said that a woman's work is never done. I have before me a special report of the United States Revenue Commission on Petroleum as a source of national revenue and it is an indication that the work of Congress is never done.

This document was dated from the Office of the United States Revenue Commission February 1866. It was addressed to the Honorable Hugh McCullough, Secretary of the Treasury, and it begins:

SIR: By the act entitled "An act to provide internal revenue to support the Government and to pay interest on the public debt," approved July 1, 1862, a duty was imposed on coal illuminating oil, refined, produced by the distillation of coal asphaltum, shale, peet, petroleum, or rock oil, and all other bituminous substances used for like purposes, 10 cents per gallon.

We need some revenue, gentlemen.

Mr. JACOBSEN. $4.20 a barrel.

The CHAIRMAN (reading):

Provided that such oil refined and produced by the distillation of coal exclusively shall be subject to pay a duty of 8 cents per gallon, anything in this act to the contrary notwithstanding.

There is a very substantial amount of information in this document, but it concludes with a few paragraphs that may be of interest to the group, entitled "Future supplies."

Dr. WILSON. This is 7 years after oil was discovered in this country, I may say.

The CHAIRMAN (reading):

Should Congress repeal the duty on imported petroleum, the production will probably be increased as hereinbefore estimated. How long the present production will continue is purely a matter of surmise, but from present appearances, and considering the permanent character of the wells in the Nation, it sounds reasonable to suppose that it will always be sufficient for the wants of this country. Should it however come to an end, an ample and permanent supply of oil will be obtained, but at higher prices, from the shales and rich bituminous coals which are found in almost all parts of the United States and in the greatest abundance.

Mr. JACOBSEN. I move that we adjourn at this time, Mr. Chairman.

Mr. KAYSER. We should not have come here.

The CHAIRMAN. This is signed "S. S. Hayes, chairman of the special committee."

The CHAIRMAN. Mr. Ball, I ask you, have you any additional comment to make now?

Mr. BALL. No. I would merely comment on the statement in 1866 that it seems reasonable to suppose that the supply will always be sufficient for the wants of this country. That was 1866, and with the substitution of "For a long time to come" in place of "always," I subscribe to it in 1951.

The CHAIRMAN. May I say to you gentlemen that, being absent this morning, I do not know of course what was presented by the panel, but we invited you here to suggest to the committee what should be done and what this committee should do to pursue this study to the greatest advantage for all concerned, and primarily for the greatest advantage of all the people of the United States.

Have you worked out an agenda for us?

Dr. WILSON. I think so far as oil is concerned if you will simply reiterate your previous report, we will be happy. I do not know what coal and gas might feel they need.

The CHAIRMAN. Let us turn to coal.

Mr. POTTER. If the United States will adopt the same policy for coal as it adopts for oil and gas, I think we would be quite happy.

The CHAIRMAN. Mr. Kayser?

Mr. KAYSER. As far as gas is concerned, we are very well satisfied with the situation as it has been developing over the last 5 or 6 years, and that has been due to the policy that the Congress and the people have adopted and have put into effect in respect to the use of gas and the development of transportation for gas over that period. I believe that the continuance of that policy, modified as it will undoubtedly have to be to some extent by the necessities of the definite program in respect to steel, I believe with the continuance of that policy, the industry will be healthy and it will perform its part of its duty and its obligations, and its part in the development of the economy of this country.

The CHAIRMAN. Suggestions were made, Mr. Earnest, at the time the resolution was discussed in the committee, that in some of the coal areas of the United States communities are suffering or have been suffering by reason of the conditions which were developing, and some suggestion was made that we should make field studies in some parts of the country. What have you to say about that?

Mr. EARNEST. I am not familiar with the statements you refer to, Senator.

The CHAIRMAN. Are the communities in the anthracite region all prospering?

Mr. EARNEST. There is a considerable amount of unemployment in the anthracite region, but the total payroll in the mining industry itself—I mean the business insofar as the total payroll in the area is concerned—is very high. There always has been a large amount of unemployment in the anthracite region.

Mr. TAGGART. Mr. Chairman, so far as we are concerned, I think Mr. Cooke put in a statement this morning relative to the suggestions of the solid fuel industry. We think that the purposes of the original resolution could not be answered in such a general way as they have been answered here, that the hearings should be continued, and that there should be a determination by your committee as to whether or not a fuel policy is presently needed in the United States, going back as nearly as I can recall the resolution, upon which the domestic economy in time of peace and time of war can continue to expand. We understood that this was just a round-table discussion leading up to further hearings.

The CHAIRMAN. That is right.

Mr. TAGGART. Are we correct in that?

The CHAIRMAN. That is correct, sir.

Mr. TAGGART. Well, if that is correct, we rest.

The CHAIRMAN. My question was whether there were any members of the panel who had any particular suggestion as to the nature and the place of the hearings. I might say that the United States Geological Survey is presently engaged at the request of this committee, in preparing a study of all fuel reserves, which will soon be ready. The

reserve question is an important question to the understanding of our situation and the formulation of any policy, of course.

We invited the representatives of the Department of the Interior to attend these hearings. They were here in number at the outset. I looked around this afternoon for some of the representatives of the Bureau of Mines in the synthetic fuel program, but cannot seem to find them. The Interior Department will be given an opportunity to be heard on this matter. This record will be printed and the galley proofs will be sent to each participant, so that you may examine your testimony, and I shall request that when you see that testimony and have been able to evaluate it again, you may perhaps desire to address the committee with any further suggestions that occur to you on the basis of this round-table discussion.

I know that the members of the committee who have been able to attend here have found it highly informative, and we are most grateful to all of you who have given so much of your time and your knowledge of the problem to help the committee.

Mr. JACOBSEN. Mr. Chairman, with regard to further hearings with respect to oil, I would like to say this: the special committee of the Senate, of which you were the chairman 3 or 4 years ago, held most exhaustive hearings covering every possible phase of the oil industry.

The CHAIRMAN. With respect to that, we only need to bring it up to date.

Mr. JACOBSEN. That is what I was going to say, that if you were today to repeat those hearings, the statements that would be put in by oil industry representatives would be essentially repetitious of what was stated a few years ago with the sole exception of bringing a few statistics down to date.

So far as oil is concerned, I do not think that a complete set of hearings would add anything, always provided that the records of the hearings that were held at that time are available to this committee, as I take it that they are.

The CHAIRMAN. Of course.

Mr. WILSON. When we get these million barrels a day expansion figures and the revised figures on the synthetic plants, there is that piece of information that should be added, but otherwise I agree with Mr. Jacobsen that there is very little we can add.

The CHAIRMAN. I think it is clear on the record made previously in the middle of the century and by recent committees and by our own record that the engineering resources of the United States are still extraordinary, and they hold out a wonderful opportunity for the people of this country to retain complete faith in the ability of the American people to meet every emergency that may arise, whether in peace or in war, and to continue our progress. I feel that very very definitely. It is important, however, that we should consider all of these fuels together and in contrast with one another, so that we may continue to do the best we can in this country to promote the development of every area and continue to expand the economy so that we may have a rising standard for all of our people, and more than that, in my opinion, to show the people of the rest of the world, by example, what can be done by people who are free and are willing to preserve that freedom.

If there is anything else——

Mr. KAYSER. I would like on my own behalf, and I am sure on behalf of the rest of us, to thank you and all members of the committee

for having given us the opportunity to come here and express in this informal manner our ideas on this subject. In addition to that, I want to express appreciation for this monograph of basic data relating to energy resources. So far as I am concerned, from here on it will be more or less a bible of statistics on this subject. It has been extremely enlightening to me to have that to study and to listen to this discussion which has, after all, resolved around the data set forth.

The CHAIRMAN. The committee and the staff are most grateful to you for the compliment, and I think I ought to ask Mr. Sandusky, counsel for this study, to stand and take a bow.

Senator LONG. I also want to thank you, Mr. Sandusky, for these basic data. They are wonderfully illuminating, and I want to thank you gentlemen for the information you have given us here. I have attended as much as I possibly could, and I do not think I have ever acquired more knowledge in a short time than I have in attending these hearings in the past 2 days.

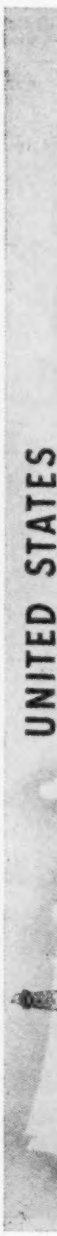
Mr. JACOBSEN. The last time I said to Senator O'Mahoney that he could charge an admission fee and still get a lot of oil people here.

The CHAIRMAN. Speak to me about that in 1952.

(Thereupon, at 4:25 p. m., the committee adjourned, subject to the call of the chairman.)

APPENDIX 1

STATISTICAL CHARTS PREPARED BY PETROLEUM ADMINISTRATION FOR DEFENSE, DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C.



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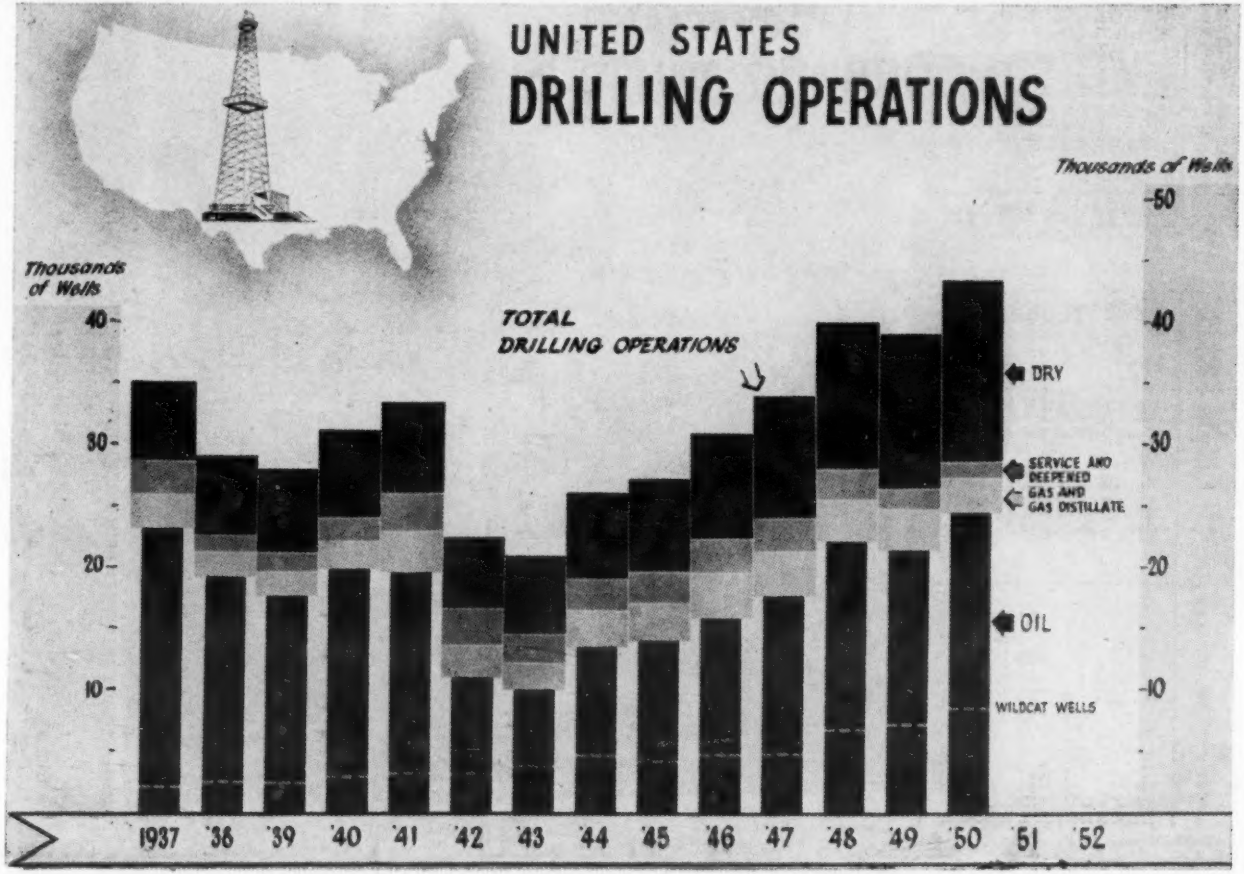
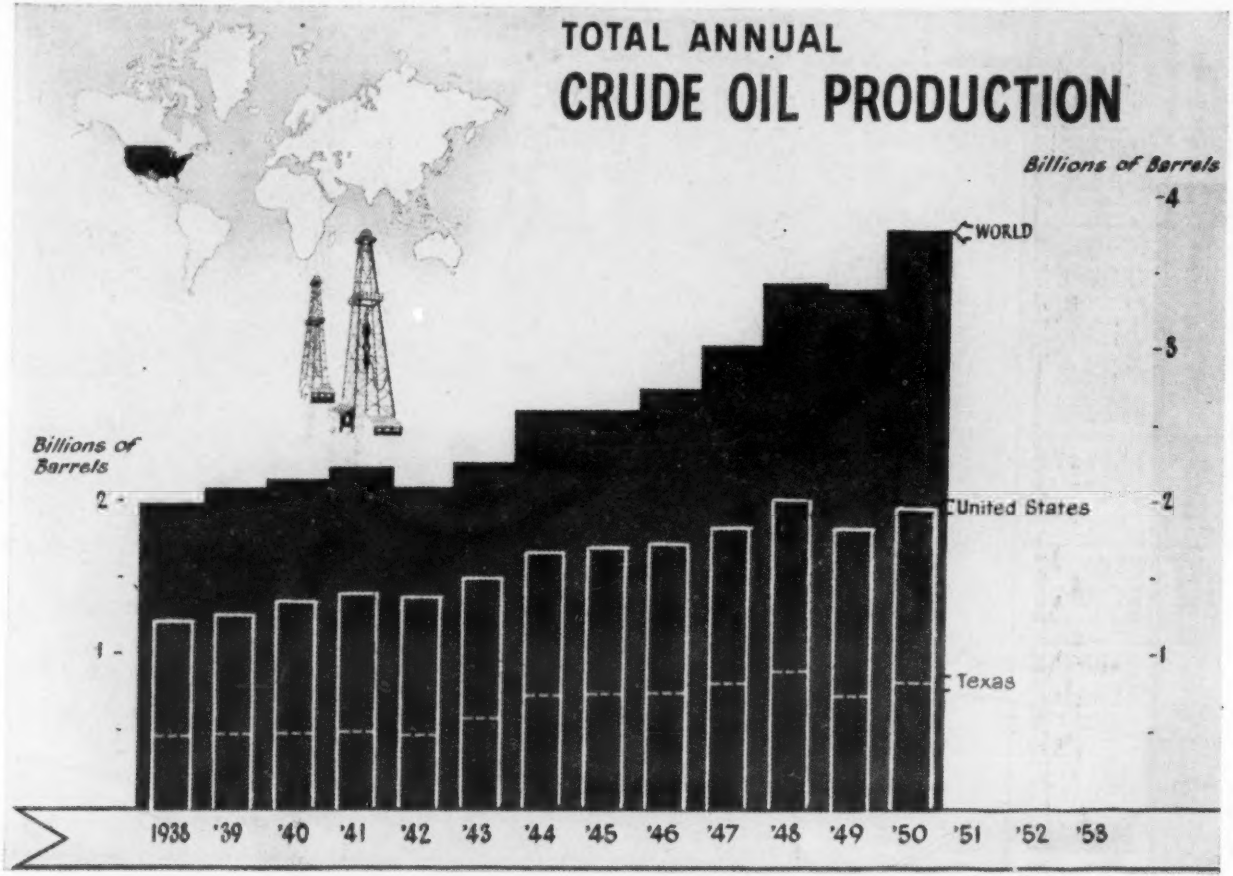


P. A. D. Chart 1—Jan. 1951

United States drilling operations—wells

Year	Oil	Gas and distillate	Service and deepened	Dry	Total well completions	Wildcat wells drilled
1937	23,115	2,732	2,739	6,627	35,213	2,224
1938	19,106	2,143	1,363	6,515	29,127	2,638
1939	17,734	2,030	1,358	6,890	28,012	2,589
1940	19,843	2,265	1,988	7,053	31,149	3,038
1941	19,590	3,279	3,183	7,280	33,332	3,264
1942	10,977	2,790	2,849	5,962	22,578	3,212
1943	9,887	2,390	2,179	6,364	20,820	3,843
1944	13,502	3,078	2,430	7,153	26,163	4,778
1945	13,944	3,192	2,658	7,346	27,140	4,256
1946	16,087	3,562	2,700	8,496	30,845	4,830
1947	17,613	3,720	2,714	9,751	33,798	4,846
1948	22,197	3,312	2,562	11,939	40,010	6,877
1949	21,352	3,363	1,703	12,597	39,015	7,294
1950	24,430	2,843	1,249	14,757	43,279	8,554

TOTAL ANNUAL

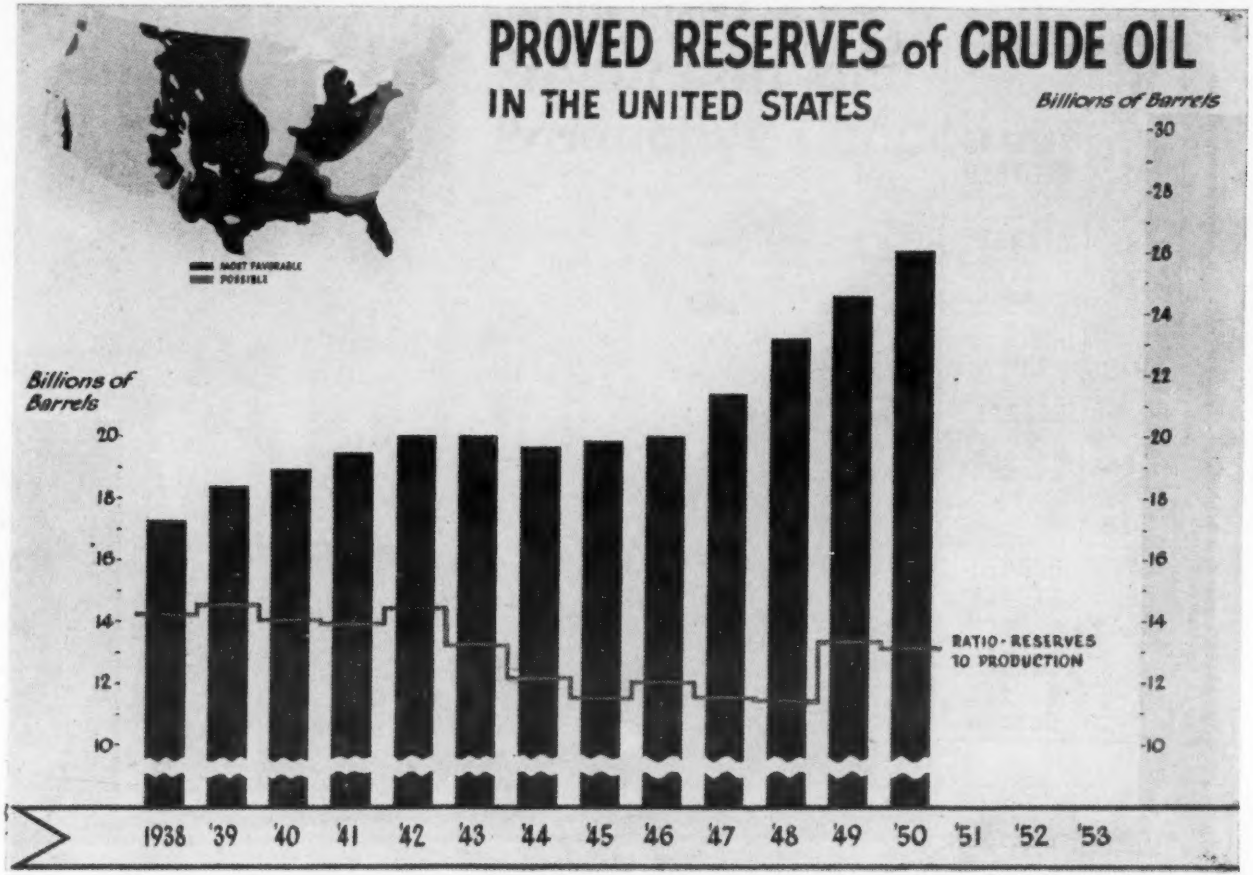


P. A. D. Chart 2—Jan. 1951

Total annual crude-oil production

[Thousands of barrels]

Year	World production	United States production	Texas production	Year	World production	United States production	Texas production
1938	1,988,041	1,214,355	475,850	1945	2,594,798	1,713,655	754,710
1939	2,086,160	1,264,962	483,528	1946	2,745,474	1,733,939	760,215
1940	2,149,821	1,353,214	493,209	1947	3,022,075	1,856,987	820,210
1941	2,220,657	2,402,228	505,572	1948	3,433,021	2,020,158	903,498
1942	2,093,100	1,386,645	483,097	1949	3,398,789	1,841,940	744,834
1943	2,256,637	1,505,613	594,343	1950	3,786,000	1,973,000	830,000
1944	2,592,371	1,677,904	746,999				



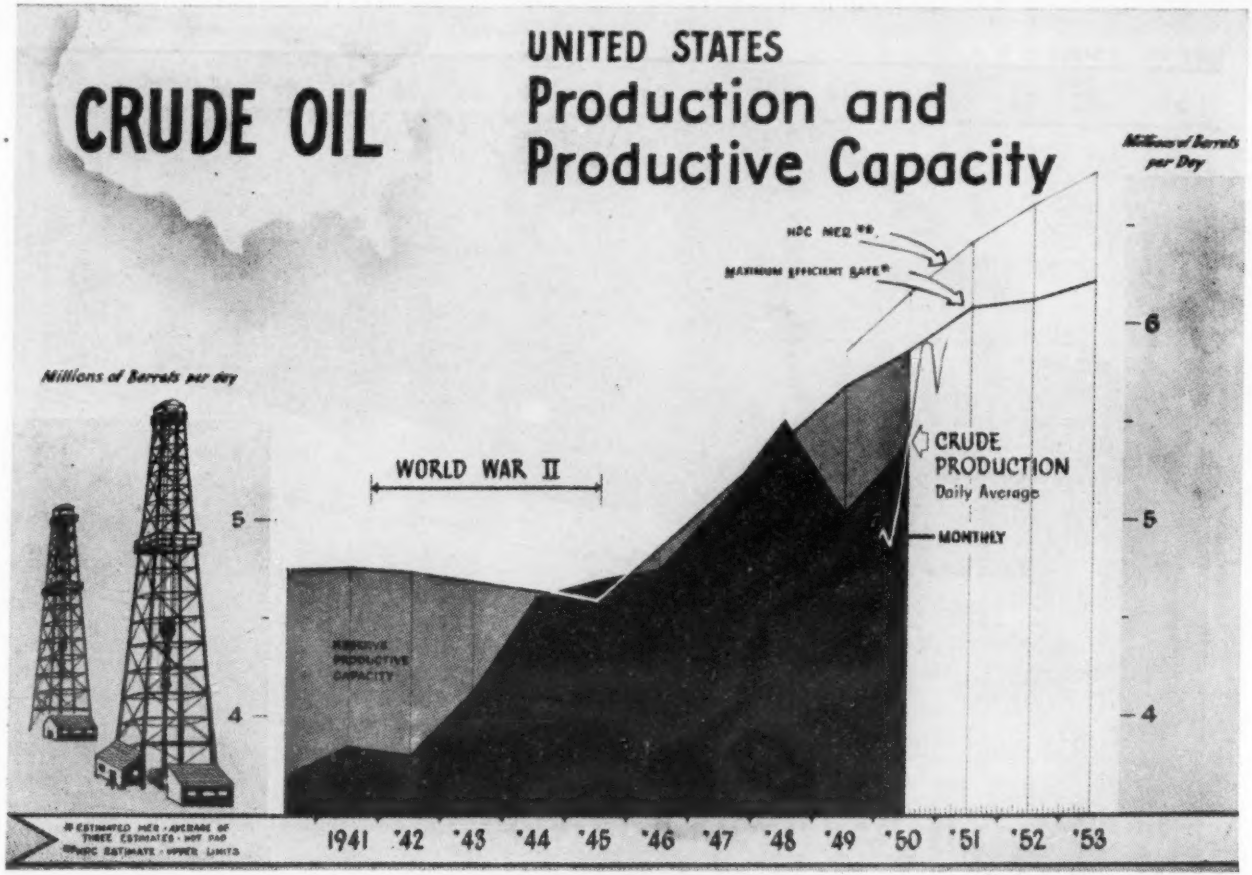
P. A. D. Chart 3—Jan. 1951

Proved reserves of crude oil in the United States

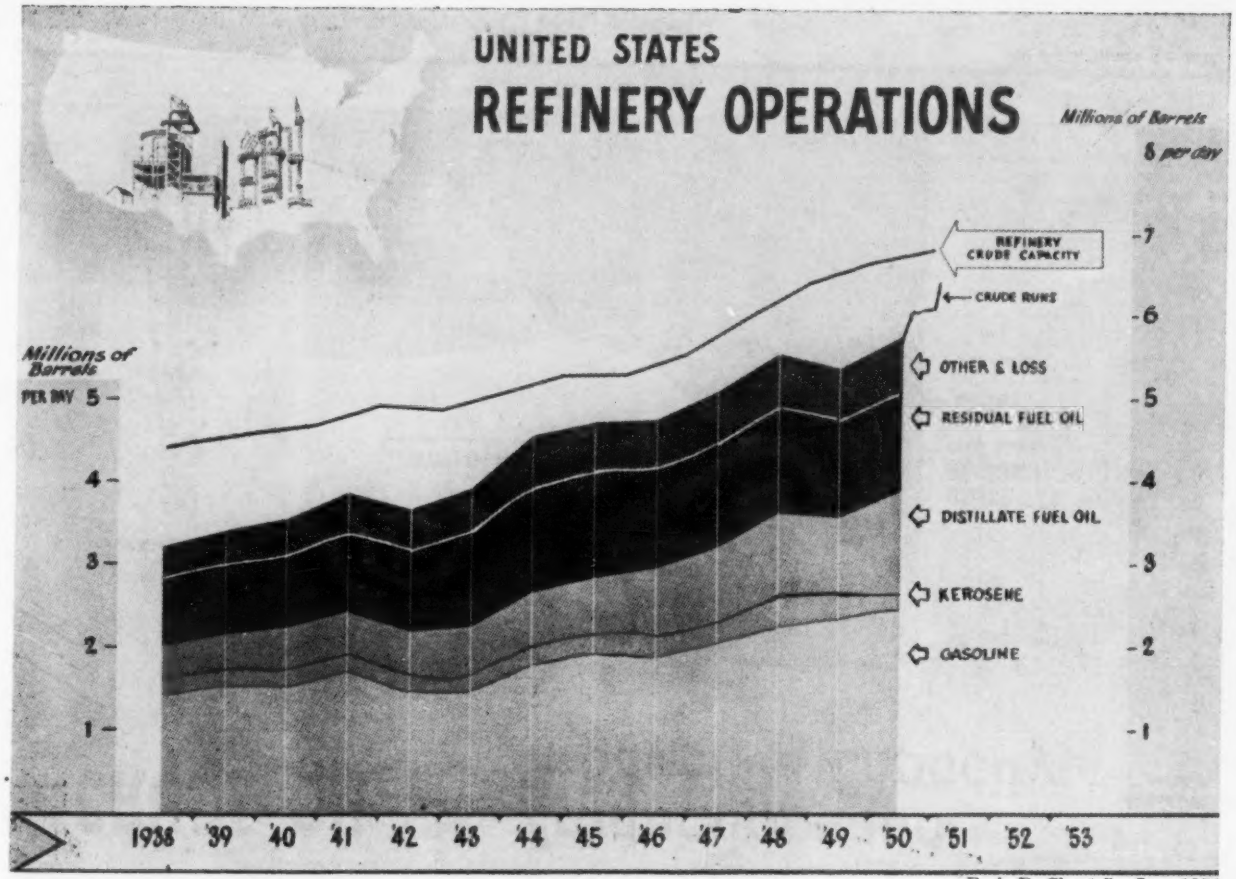
[Thousands of barrels]

Year	Reserves of crude oil, cycle plant, and lease condensate			Year	Reserves of crude oil only		
	Proved reserves, Dec. 31	Actual production during the year	Ratio: reserves to production		Proved reserves, Dec. 31	Actual production during the year	Ratio: reserves to production
1938	17,348,146	1,214,355	14.3	1944	19,784,530	1,677,904	12.2
1939	18,483,012	1,264,962	14.6	1945	19,941,846	1,713,655	11.6
1940	19,024,515	1,353,214	14.1	1946	20,873,560	1,733,939	12.1
1941	19,589,296	1,402,228	14.0	1947	21,487,685	1,856,987	11.6
1942	20,082,793	1,386,645	14.5	1948	23,280,444	2,020,185	11.5
1943	20,064,152	1,505,613	13.3	1949	24,649,489	1,841,940	13.4
				1950	26,121,000	1,973,000	13.2

UNITED STATES
Production and
CRUDE OIL



P. A. D. Chart 4—Jan. 1951



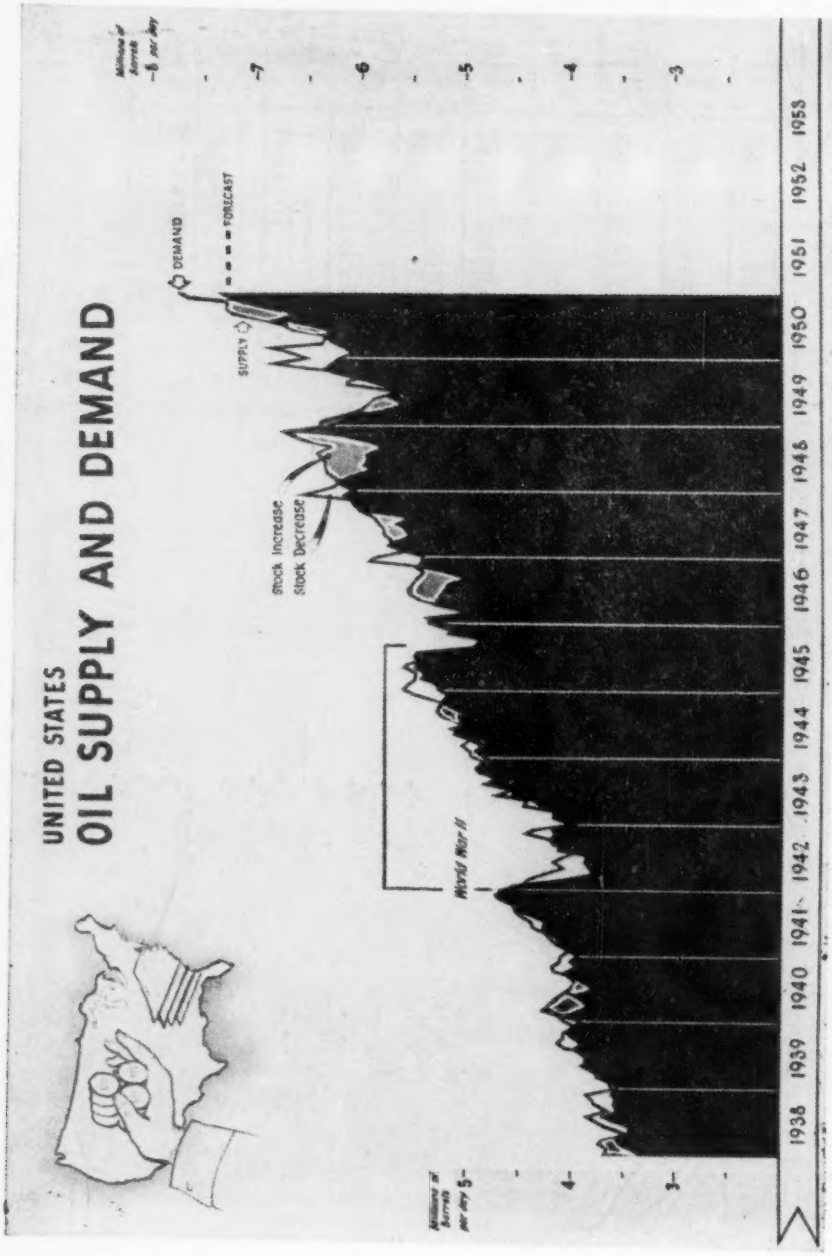
P. A. D. Chart 5—Jan. 1951

United States refinery operations

[Thousands of barrels per day]

Year	Refinery yields from crude runs					Refinery input		Total refinery output	Refinery crude capacity		
	Gasoline	Kerosene	Distillate fuel oil	Residual fuel oil	Other and loss	Total crude runs	Natural gasoline [1]		Year end	Year average	Unused capacity
1938	1,414	177	416	808	377	3,192	109	3,301	4,351	4,430	1,238
1939	1,526	188	443	838	396	3,391	109	3,500	4,509	4,569	1,178
1940	1,524	202	501	864	445	3,536	108	3,644	4,629	4,674	1,138
1941	1,708	199	518	938	498	3,861	131	3,998	4,719	4,838	977
1942	1,453	185	539	983	495	3,655	155	3,810	4,957	4,930	1,275
1943	1,455	198	580	1,143	541	3,917	168	4,085	4,902	4,998	1,081
1944	1,791	214	653	1,261	632	4,551	184	4,735	5,093	5,197	646
1945	1,929	222	683	1,286	591	4,711	193	4,904	5,301	5,308	597
1946	1,878	286	789	1,182	605	4,740	172	5,913	5,315	5,442	702
1947	2,039	303	855	1,227	651	5,075	194	5,268	5,569	5,802	727
1948	2,240	333	1,040	1,274	662	5,549	208	5,758	6,034	6,237	688
1949	2,338	280	934	1,164	639	5,355	234	5,589	6,439	6,568	1,213
1950	2,473	324	1,089	1,162	711	5,759	260	6,019	6,696	6,773	1,014
December 1950						6,090			6,850		760
January 1951						6,425			6,850		425

[1] Natural gasoline blended and used at refineries.
1950 figures subject to revision.



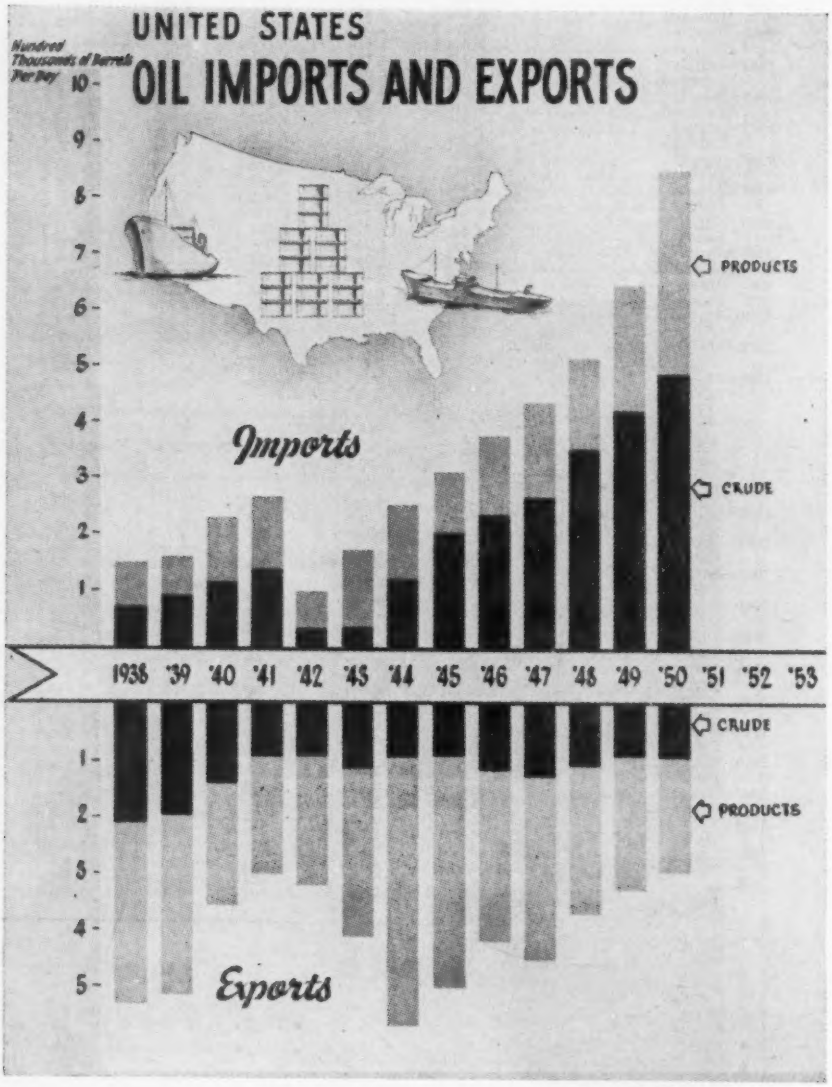
P. A. D. Chart 6—Jan. 1951

United States oil supply and demand

[Thousands of barrels per day]

	January	February	March	April	May	June
1938—Supply	3,707	3,669	3,745	3,717	3,459	3,446
Demand	3,344	3,410	3,564	3,589	3,515	3,680
1939—Supply	3,579	3,609	3,724	3,824	3,922	3,846
Demand	3,613	3,649	3,777	3,671	3,884	3,879
1940—Supply	3,947	4,132	4,297	4,235	4,186	4,110
Demand	4,095	3,698	3,949	3,849	3,917	4,032
1941—Supply	3,962	4,056	4,129	4,144	4,216	4,296
Demand	4,115	4,046	4,156	4,214	4,257	4,389
1942—Supply	4,633	4,572	4,107	3,819	3,843	3,894
Demand	4,709	4,475	4,429	4,271	4,110	4,201
1943—Supply	4,056	4,190	4,184	4,304	4,371	4,587
Demand	4,041	4,199	4,176	4,482	4,451	4,784
1944—Supply	4,863	4,940	4,890	4,997	5,156	5,122
Demand	4,986	4,992	5,072	5,008	5,049	5,201
1945—Supply	5,300	5,326	5,470	5,438	5,537	5,501
Demand	5,640	5,593	5,521	5,526	5,641	5,584
1946—Supply	5,337	5,448	5,064	5,316	5,491	5,597
Demand	5,412	5,334	5,073	5,235	5,347	5,300
1947—Supply	5,468	5,670	5,764	5,777	5,831	5,830
Demand	5,919	6,047	5,806	5,709	5,580	5,645
1948—Supply	6,134	6,265	6,292	6,378	6,384	6,395
Demand	6,458	6,269	6,251	6,109	5,941	6,050
1949—Supply	6,438	6,419	6,182	6,021	5,968	5,908
Demand	6,347	6,214	6,164	5,826	5,634	5,786
1950—Supply	6,251	6,137	6,218	6,324	6,369	6,691
Demand	6,594	6,767	6,984	6,403	6,382	6,334

	July	August	September	October	November	December	Year average
1938—Supply	3,613	3,725	3,569	3,592	3,587	3,627	3,621
Demand	3,598	3,878	3,680	3,783	3,819	3,878	3,646
1939—Supply	3,910	2,919	3,920	4,007	4,055	3,996	3,776
Demand	3,799	4,060	4,159	4,093	4,089	3,998	3,891
1940—Supply	4,029	3,984	4,034	4,084	3,975	4,033	4,087
Demand	3,799	3,915	3,992	4,185	4,205	4,126	3,981
1941—Supply	4,278	4,393	4,558	4,572	4,690	4,756	4,339
Demand	4,402	4,502	4,551	4,444	4,621	4,708	4,369
1942—Supply	3,862	4,154	4,130	4,212	4,186	4,205	4,132
Demand	4,099	3,966	4,183	4,227	4,487	4,370	4,293
1943—Supply	4,565	4,841	4,758	4,909	4,946	4,816	4,546
Demand	4,617	4,887	4,747	4,737	4,937	4,875	4,579
1944—Supply	5,090	5,250	5,311	5,296	5,261	5,218	5,117
Demand	5,030	5,090	5,087	5,184	5,356	5,542	5,134
1945—Supply	5,536	5,502	4,959	4,917	5,226	5,135	5,321
Demand	5,407	5,270	4,974	4,820	5,085	5,250	5,358
1946—Supply	5,601	5,568	5,522	5,463	5,531	5,474	5,450
Demand	5,252	5,220	5,056	5,258	5,493	5,988	5,331
1947—Supply	5,881	5,928	6,045	6,100	6,132	6,221	5,888
Demand	5,777	5,580	5,956	6,070	6,070	6,673	5,902
1948—Supply	6,427	6,477	6,357	6,592	6,709	6,808	6,436
Demand	5,974	5,995	5,848	5,959	6,191	6,654	6,143
1949—Supply	5,723	5,826	6,015	6,253	6,407	6,336	6,123
Demand	5,730	6,173	6,179	6,000	6,556	6,959	6,130
1950—Supply	6,774	7,002	7,262	7,327	7,324	7,302	6,748
Demand	6,500	6,959	6,718	6,906	7,165	7,681	6,783

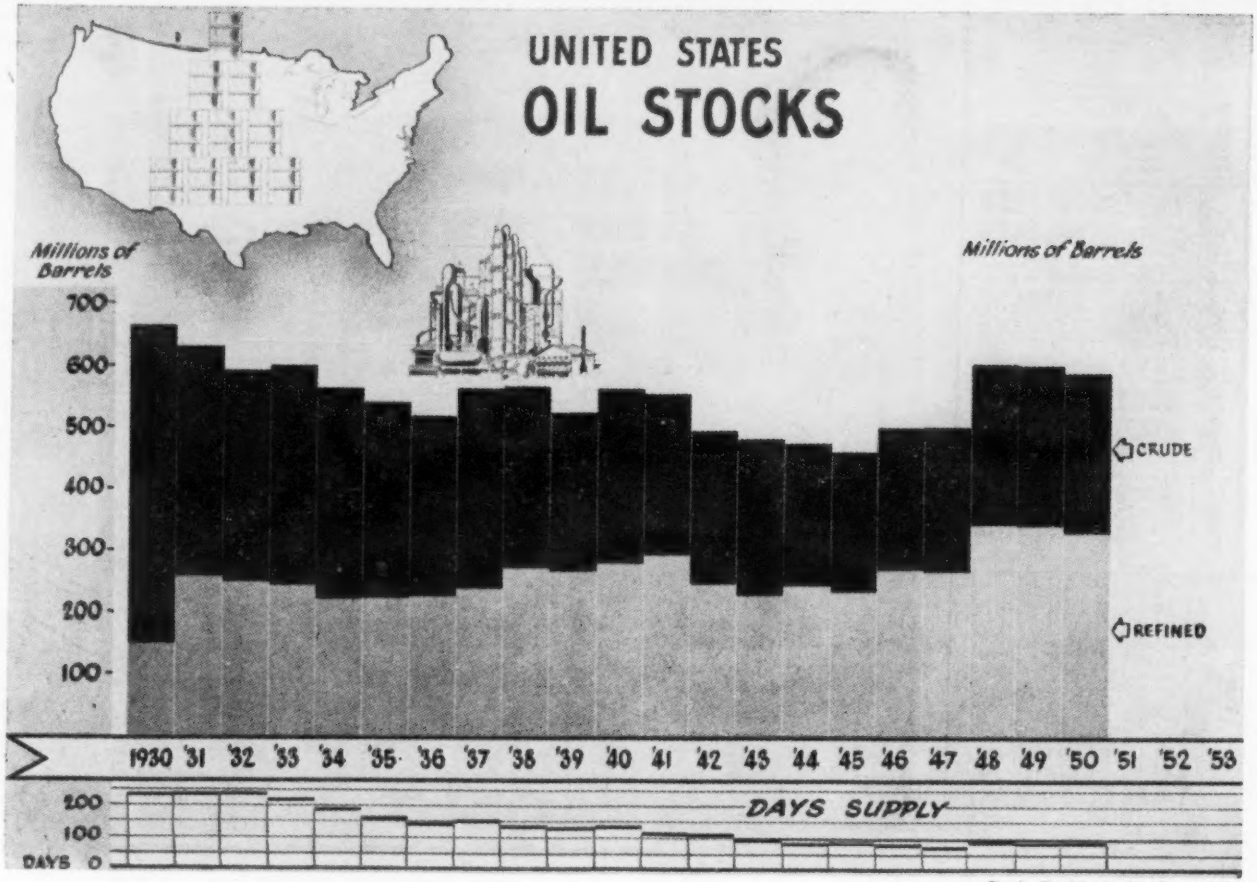


P. A. D. Chart 7—Jan. 1951

United States oil imports and exports (excluding United States military)

[Barrels per day]

Year	Imports			Exports		
	Crude	Products	Total	Crude	Products	Total
1938	72,400	76,400	148,800	211,700	319,100	530,800
1939	90,700	71,100	161,800	197,500	320,200	517,700
1940	116,500	112,300	228,800	140,700	215,800	356,400
1941	138,600	127,500	266,100	91,100	207,100	298,200
1942	33,700	64,800	98,500	92,700	227,600	320,300
1943	37,900	135,800	173,700	113,300	297,600	410,800
1944	122,400	129,800	252,200	93,500	473,700	567,300
1945	203,700	107,600	311,300	90,400	410,900	501,300
1946	235,800	141,400	377,200	116,300	303,200	419,500
1947	267,200	169,500	436,700	127,000	323,600	450,600
1948	352,700	161,300	514,000	108,600	259,400	368,000
1949	421,100	224,300	645,400	90,600	236,500	327,100
1950	486,900	360,100	847,000	93,200	202,700	295,900



P. A. D. Chart 8—Jan. 1951

United States oil stocks

[Thousands of barrels]

Year	Crude oil	Natural gasoline	Refined products	Total refined oils	Grand total	Number of days supply
1930	512,230	2,377	150,890	153,267	665,497	240
1931	370,194	2,825	258,879	261,704	631,980	242
1932	339,875	3,203	249,116	252,319	592,194	244
1933	354,223	3,680	244,495	247,975	602,198	225
1934	337,254	4,216	222,678	226,894	564,148	197
1935	314,631	3,698	223,371	227,069	541,700	166
1936	288,579	4,055	226,595	230,650	519,229	146
1937	320,338	4,758	239,901	244,659	564,997	155
1938	290,632	4,830	272,241	277,071	567,703	147
1939	253,308	4,421	268,109	272,530	525,838	132
1940	276,615	5,704	280,958	286,662	563,277	137
1941	257,678	4,437	294,310	298,747	556,425	118
1942	245,754	4,632	247,554	252,186	497,940	114
1943	249,404	4,541	229,362	233,903	483,307	99
1944	226,770	4,451	245,868	250,319	477,089	86
1945	223,259	4,322	235,998	240,320	463,579	88
1946	230,176	4,981	271,937	276,918	507,094	85
1947	230,654	4,296	267,103	271,399	502,053	75
1948	256,627	5,579	343,537	349,116	605,743	92
1949	253,356	6,831	342,932	349,763	603,119	87
1950	253,000	7,400	330,600	338,000	591,000	87

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P. A. D. Chart 8—Jan. 1951

APPENDIX 2

Reserve Reports of the American Petroleum Institute and the American Gas Association

SUMMARY

The American Petroleum Institute and the American Gas Association present herewith the annual reports of their respective reserves committees for the year 1950.

As in the case of the reports for the four previous years, the crude-oil reserves were estimated by the American Petroleum Institute committee, the natural-gas reserves by the American Gas Association committee, and the natural-gas liquid reserves—condensate, natural gasoline, and liquefied petroleum gasses—by both committees.

These reports indicate the following comparative liquid hydrocarbon and gas reserves at the end of 1949 and 1950, and the production of liquid hydrocarbons and natural gas during those 2 years.

Reserves	Dec. 31, 1949	Dec. 31, 1950	Increase 1950 over 1949
Crude oil.....barrels of 42 gallons..	24,649,489,000	25,268,398,000	618,909,000
Natural-gas liquids.....do....	3,729,012,000	4,267,663,000	538,651,000
Total liquid hydrocarbons.....do....	28,378,501,000	29,536,061,000	1,157,560,000
Natural gas.....thousands of cubic feet..	180,381,344,000	185,592,699,000	5,211,355,000

Production	1949	1950	Increase 1950 over 1949
Crude oil.....barrels of 42 gallons..	1,818,800,000	1,943,776,000	124,976,000
Natural-gas liquids.....do....	198,547,000	227,411,000	28,864,000
Total liquid hydrocarbons.....do....	2,017,347,000	2,171,187,000	153,840,000
Natural gas.....thousands of cubic feet..	6,245,041,000	6,892,678,000	647,637,000

The gas-production figures indicated above are net after deducting only the amount of gas returned to reservoirs for cycling and pressure maintenance. They therefore include the gas put into underground storage.

The separate reports of the two committees follow.

REPORT OF THE AMERICAN PETROLEUM INSTITUTE'S COMMITTEE ON PETROLEUM RESERVES

To the Board of Directors, American Petroleum Institute:

Your committee on petroleum reserves herewith submits its annual report on proved liquid hydrocarbon reserves of the United States as of December 31, 1950. As will be recalled, beginning with our report for December 31, 1946, the estimates presented on proved liquid hydrocarbon reserves were expanded to include not only crude oil but also all classes of natural-gas liquids. (See definition of natural-gas liquids as given by AGA committee in copy of its report attached hereto.) The figures on crude oil were prepared by the API committee, and the figures on natural-gas liquids were prepared by the AGA committee in cooperation with the API committee. For the present report, the same procedure has been followed.

As of December 31, 1950, the committee estimates that the proved reserves of crude oil in the United States amounted to 25,268,398,000 barrels. The natural-gas liquids totaled 4,267,663,000 barrels, making a grand total of 29,536,-061,000 barrels. This is shown in the following tabulations which include in their respective States the offshore proved reserves in California, Louisiana, and Texas.

Table I

(A) CRUDE OIL—AMERICAN PETROLEUM INSTITUTE

[Barrels of 42 United States gallons]

Total proved reserves of crude oil as of Dec. 31, 1949		24, 649, 489, 000
Revisions of previous estimates	+663, 378, 000	
Extensions of old pools	1, 334, 391, 000	
New reserves discovered in 1950 in new fields and in new pools in old fields	564, 916, 000	
Proved reserves added in 1950		2, 562, 685, 000
Total proved reserves as of Dec. 31, 1949, plus new proved reserves added in 1950		27, 212, 174, 000
Less production during 1950 [1]		1, 943, 776, 000
Total proved reserves of crude oil as of Dec. 31, 1950		25, 268, 398, 000
Increase in crude oil reserves during 1950		618, 909, 000

(B) NATURAL GAS LIQUIDS—AMERICAN GAS ASSOCIATION AND AMERICAN PETROLEUM INSTITUTE

[Barrels of 42 United States gallons]

Total proved reserves of natural gas liquids as of Dec. 31, 1949		3, 729, 012, 000
Revisions of previous estimates and extensions of old pools	+707, 879, 000	
New reserves discovered in 1950 in new fields and in new pools in old fields	58, 183, 000	
Proved reserves added in 1950		766, 062, 000
Total proved reserves as of Dec. 31, 1949, plus new proved reserves added in 1950		4, 495, 074, 000
Less production during 1950 [1]		227, 411, 000
Total proved reserves of natural gas liquids as of Dec. 31, 1950		4, 267, 663, 000
Increase in natural gas liquids reserves during 1950		538, 651, 000

(C) TOTAL LIQUID HYDROCARBONS—A. P. I. AND A. G. A.[2]

[Barrels of 42 United States gallons]

Total proved reserves as of Dec. 31, 1949		28, 378, 501, 000
Revisions of previous estimates and extensions of old pools	+2, 705, 648, 000	
New reserves discovered in 1950 in new fields and in new pools in old fields	623, 099, 000	
Proved reserves added in 1950		3, 328, 747, 000
Total proved reserves as of Dec. 31, 1949, plus new proved reserves added in 1950		31, 707, 248, 000
Less production during 1950 [1]		2, 171, 187, 000
Total proved reserves of liquid hydrocarbons as of Dec. 31, 1950		29, 536, 061, 000
Increase in total liquid hydrocarbon reserves during 1950		1, 157, 560, 000

[1] The 1950 production figures were compiled by the committee and where necessary are based on 11 months' actual production with an estimate for December. Any variance between the actual production, as later reported, and the figures used herein will be compensated for through revision when the following year's reserve report is compiled. These revisions have in the past been very small.

[2] Tables Ia and Ib combined.

The estimates in this report, as in all previous annual reports of this committee, refer solely to proved or blocked-out reserves. They include only oil and natural gas liquids recoverable under existing economic and operating conditions.

The estimates made for this report by your committee do not include:

1. Oil [1] under the unproved portions of partly developed fields.
2. Oil in untested prospects.
3. Oil that may be present in unknown prospects in regions believed to be generally favorable.
4. Oil that may become available by fluid injection methods from fields where such methods have not yet been applied.
5. Oil that may become available through chemical processing of natural gas.
6. Oil that can be made from oil shale, coal, or other substitute sources. Proved reserves are both drilled and undrilled. The proved drilled reserves, in any pool, include the oil estimated to be recoverable by the production systems now in operation, whether with or without fluid injection, and from the area actually drilled up on the spacing pattern in vogue in that pool. The proved undrilled reserves, in any pool, include reserves under undrilled spacing units which are so close, and so related, to the drilled units that there is every reasonable probability that they will produce when drilled.

This committee uses the term "fluid injection" to include (1) what is commonly called "pressure maintenance"; (2) cycling and recycling; and (3) secondary recovery in its original sense, namely, fluid applied relatively late in the development history of a reservoir (pool) with the purpose of stimulating petroleum production after recovery by primary methods of flowing and pumping has approached an economic limit. Since fluid injection methods may be installed at any time during the period of exploitation of a pool (or field), determination of those reserves which might be obtainable without fluid injection, and those which might be obtainable as a result of fluid injection, would be impossible.

In the case of new discoveries, both of new fields and of new pools (pays, reservoirs) in oil fields, which are seldom fully developed in the first year and in fact for several years thereafter, the estimates of proved reserves necessarily represent but a part of the reserves which may ultimately be assigned to the new reservoirs discovered each year. For a one-well field, where development has not yet gone beyond the discovery well, the area assigned as proved is usually small in regions of complex geological conditions but may be larger where the geology is relatively simple. In a sparsely drilled pool the area between wells is considered to be proved only if the geological and engineering data assure that such area will produce when drilled. The total of new oil through discoveries estimated as proved in each year is comparatively small, because development is usually not extensive during the first year. The total of new oil through extensions, on the other hand, is comparatively large. As knowledge of the factors affecting production and reservoir performance becomes available, and as these factors are studied, reserves in older fields can be estimated with greater precision and revised accordingly. Therefore, the total quantity of the new proved reserves for the year includes the oil from discoveries, extensions and revisions of previous estimates.

The committee again wishes especially to stress the fact that its estimates of proved reserves cannot be used in measuring the rate at which these reserves can be produced with or without physical waste. Oil cannot be produced from the permeable rocks in which it occurs at any desired rate, because the flow of oil through the pores of the oil-bearing rocks is definitely controlled by the physical factors of the reservoir. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates. This has been widely demonstrated by past performance under all kinds of operating conditions. Therefore, only incorrect conclusions as to the life of these reserves can be obtained by dividing these reserves by the current rate of production.

In table 2 we show, in column 1, the crude oil reserves as of December 31, 1949. In column 2 are the changes in these crude-oil estimates due to extensions and revisions. In column 3 are the new reserves of crude oil discovered in 1950 in new fields and also in new pools (pays, reservoirs) in old fields. In column 4 are shown the committee's figures on production of crude oil (see footnote on production following table 1), and in column 5 are shown the remaining reserves of crude oil as of December 31, 1950. Column 6 shows the changes in crude-oil reserves during 1950.

[1] The word "oil" unless defined as crude oil, is used in this report as essentially equivalent to liquid hydrocarbons.

In table 3, in column 1, are shown the reserves of natural gas liquids (condensate, natural gasoline and liquefied petroleum gases—see complete definition in AGA report) as of December 31, 1949. In column 2 are the changes in these natural gas liquids estimates due to extensions and revisions. In column 3 are the new reserves of natural gas liquids discovered in 1950, in new fields and also in new pools (pays, reservoirs) in old fields. In column 4 are shown the figures on production of natural gas liquids, and in column 5 are shown the remaining reserves of natural gas liquids as of December 31, 1950. Column 6 shows the changes in natural gas liquid reserves during 1950.

Table 4 is a consolidation of tables 2 and 3, and shows the total liquid hydrocarbon reserves as of December 31, 1949, and 1950, with related data, by States.

For comparative purposes we append a summary (table 5) of the over-all figures contained in the committee's annual reports covering the period from 1937 to 1950, inclusive. Figures for 1935 and 1936, which were the first developed by the committee, are not available separately.

As in the past, this committee wishes to emphasize the fact that every effort has again been made to secure a fair, unprejudiced, and representative opinion. Each member in his district appointed a number of subcommittees to gather and study the necessary data. All previously determined factors pertaining to the various pools were examined and adjusted in the light of new information. The subcommittees which were largely responsible for the data were comprised of geologists and petroleum engineers with long experience in this class of work. We wish to acknowledge the valuable assistance of all those who have cooperated in this undertaking.

Respectfully submitted.

The Committee on Petroleum Reserves: F. H. Lahee, chairman, Sun Oil Co., Dallas, Tex.; D. V. Carter, vice chairman, Magnolia Petroleum Co., Dallas, Tex.; Fred Van Covern, secretary, American Petroleum Institute, New York, N. Y.; R. F. Baker, the Texas Co., New York, N. Y.; Frank R. Clark, the Ohio Oil Co., Tulsa, Okla.; Morgan J. Davis, Humble Oil & Refining Co., Houston, Tex.; Alexander Deussen, consulting geologist, Houston, Tex.; Graham B. Moody, Standard Oil Co. of California, San Francisco, Calif.; J. M. Sands, Phillips Petroleum Co., Bartlesville, Okla.; P. R. Schultz, Stanolind Oil & Gas Co., Tulsa, Okla.; Theron Wasson, the Pure Oil Co., Chicago, Ill.

TABLE 2.—*Estimated proved reserves of crude oil in the United States*

[Barrels of 42 United States gallons]

	Proved reserves as of Dec. 31, 1949 (1)	Changes in proved reserves due to extensions (new crude oil) and revisions during 1950 (2)	Proved reserves discovered in new fields and in new pools in old fields in 1950 [1] (3)	Production during 1950 (4)	Proved reserves as of Dec. 31, 1950 (columns 1+2+3 less column 4) (5)	Changes in reserves during 1950 (column 5 less column 1) (6)
Alabama	3,547,000	2,376,000	116,000	643,000	5,396,000	1,849,000
Arkansas	297,463,000	69,163,000	4,284,000	29,201,000	341,709,000	44,246,000
California	3,822,751,000	227,673,000	10,745,000	327,607,000	3,733,562,000	−89,189,000
Colorado	344,812,000	15,215,000	2,590,000	23,088,000	339,529,900	−5,283,000
Illinois	468,138,000	150,509,000	8,582,000	63,011,000	564,218,000	96,080,000
Indiana	50,209,000	7,440,000	9,969,900	10,246,000	57,372,000	7,163,000
Kansas	738,390,000	73,680,000	27,698,000	107,581,000	732,187,000	−6,203,000
Kentucky	56,168,000	7,676,000	2,415,000	10,388,000	55,871,000	−297,000
Louisiana	1,909,769,000	396,285,000	79,342,000	200,259,000	2,185,137,000	275,368,000
Michigan	66,496,000	26,729,000	1,409,000	15,917,000	78,717,000	12,221,000
Mississippi	402,860,000	15,819,000	2,900,000	35,874,000	385,705,000	−17,155,000
Montana	112,393,000	7,141,000	240,000	8,502,000	111,272,000	−1,121,000
Nebraska	1,624,000	5,368,000	4,033,000	1,325,000	9,700,000	8,076,000
New Mexico	592,222,000	31,065,000	12,418,000	43,723,000	591,982,000	−240,000
New York	62,900,000			4,092,000	58,808,000	−4,092,000
Ohio	27,703,000	2,875,000		3,314,000	27,264,000	−439,000
Oklahoma	1,329,918,000	193,331,000	37,531,000	163,867,000	1,396,913,000	66,995,000
Pennsylvania	103,356,000	15,000,000		11,996,000	106,360,000	3,004,000
Texas	13,509,732,000	551,170,000	338,669,000	817,929,000	13,581,642,000	71,910,000
Utah	15,831,000	7,000,000	25,000	1,227,000	31,629,000	5,798,000
West Virginia	37,992,000	3,500,000	350,000	2,800,000	39,042,000	1,050,000
Wyoming	691,602,000	188,434,000	21,600,000	60,620,000	841,016,000	149,414,000
Miscellaneous [2]	3,613,000	320,000		566,000	3,367,000	−246,000
Total United States	24,649,489,000	1,997,769,000	564,916,000	1,943,776,000	25,268,398,000	618,909,000

[1] Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce: for, in this report, the concern is only with actually proved reserves.

[2] Under miscellaneous are included Florida, Missouri, Tennessee, and Virginia.

TABLE 3.—*Estimated proved reserves of natural gas liquids in the United States* [1]

TABLE 3.—*Estimated proved reserves of natural gas liquids in the United States* [1]

[Barrels of 42 United States gallons]

	Proved reserves as of Dec. 31, 1949 (1)	Changes in proved reserves due to extensions (new natural gas liquids) and revisions during 1950 (2)	Proved reserves discovered in new fields and in new pools in old fields in 1950 [2] (3)	Production during 1950 (4)	Proved reserves as of Dec. 31, 1950 (columns 1+2+3 less column 4) (5)	Changes in reserves during 1950 (column 5 less column 1) (6)
Alabama [3]						
Arkansas	55,642,000	745,000	230,000	3,679,000	52,938,000	−2,704,000
California	320,275,000	71,079,000	250,000	28,217,000	363,387,000	43,112,000
Colorado	24,190,000	−10,837,000		432,000	12,921,000	−11,269,000
Illinois	26,666,000	3,003,000	28,000	3,438,000	26,259,000	−407,000
Indiana	126,000	34,000	24,000	32,000	152,000	26,000
Kansas	106,405,000	60,578,000	341,000	3,746,000	163,578,000	57,173,000
Kentucky	13,245,000	308,000	154,000	1,780,000	11,927,000	−1,318,000
Louisiana	596,422,000	56,492,000	18,992,000	28,394,000	643,512,000	47,090,000
Michigan	1,203,000	−75,000	14,000	124,000	1,018,000	−185,000
Mississippi	56,407,000	2,040,000	100,000	2,650,000	55,897,000	−510,000
Montana	3,710,000	81,000		244,000	3,547,000	−163,000
Nebraska	37,000	65,000	140,000	7,000	235,000	198,000
New Mexico	85,719,000	11,773,000	1,370,000	4,965,000	93,897,000	8,178,000
Ohio	1,670,000	108,000	12,000	102,000	1,688,000	18,000
Oklahoma	234,030,000	61,897,000	4,922,000	20,946,000	279,903,000	45,873,000
Pennsylvania	2,643,000	135,000	68,000	247,000	2,599,000	−44,000
Texas	2,143,711,000	443,190,000	31,326,000	122,188,000	2,496,039,000	352,328,000
Utah	208,000	−9,000		5,000	194,000	−14,000
West Virginia	12,831,000	634,000	212,000	4,701,000	8,976,000	−3,855,000
Wyoming	43,863,000	6,636,000		1,512,000	48,987,000	5,124,000
Miscellaneous [4]	9,000	2,000		2,000	9,000	
Total, United States	3,729,012,000	707,879,000	58,183,000	227,411,000	4,267,663,000	538,651,000

[1] Includes condensate, natural gasoline, and liquefied petroleum gases. See complete definition in AGA gas report.

[2] Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce; for, in this report, the concern is only with actually proved reserves.

[3] Included in "Miscellaneous."

[4] Includes Alabama and Florida.

TABLE 4.—*Estimated proved reserves of liquid hydrocarbons in the United States*

[Barrels of 42 United States gallons]

	Proved reserves as of Dec. 31, 1949 (1)	Changes in proved reserves due to extensions (new oil) and revisions during 1950 (2)	Proved reserves discovered in new fields and in new pools in old fields in 1950 [1] (3)	Production during 1950 (4)	Proved reserves as of Dec. 31, 1950 (columns 1+2+3 less column 4) (5)	Changes in reserves during 1950 (column 5 less column 1) (6)
Alabama [2]	3,547,000	2,376,000	116,000	643,000	5,396,000	1,849,000
Arkansas	353,105,000	69,908,000	4,514,000	32,880,000	394,647,000	41,542,000
California	4,143,026,000	298,752,000	10,995,000	355,824,000	4,096,949,000	−46,077,000
Colorado	369,002,000	4,378,000	2,590,000	23,520,000	352,450,000	−16,552,000
Illinois	494,804,000	153,512,000	8,610,000	66,449,000	590,477,000	95,673,000
Indiana	50,335,000	7,474,000	9,993,000	10,278,000	57,524,000	7,189,000
Kansas	844,795,000	134,258,000	28,039,000	111,327,000	895,765,000	50,970,000
Kentucky	69,413,000	7,984,000	2,569,000	12,168,000	67,798,000	−1,615,000
Louisiana	2,506,191,000	452,777,000	98,334,000	228,653,000	2,828,649,000	322,458,000
Michigan	67,699,000	26,654,000	1,423,000	16,041,000	79,735,000	12,036,000
Mississippi	459,267,000	17,859,000	3,000,000	38,524,000	441,602,000	−17,665,000
Montana	116,103,000	7,222,000	240,000	8,746,000	114,819,000	−1,284,000
Nebraska	1,661,000	5,433,000	4,173,000	1,332,000	9,935,000	8,274,000
New Mexico	677,941,000	42,838,000	13,788,000	48,688,000	685,879,000	7,938,000
New York [3]	62,900,000			4,092,000	58,808,000	−4,092,000
Ohio	29,373,000	2,983,000	12,000	3,416,000	28,952,000	−421,000
Oklahoma	1,563,948,000	255,228,000	42,453,000	184,813,000	1,676,816,000	112,868,000
Pennsylvania	105,999,000	15,135,000	68,000	12,243,000	108,959,000	2,960,000
Texas	15,653,443,000	994,360,000	369,995,000	940,117,000	16,077,681,000	424,238,000
Utah	16,039,000	6,991,000	25,000	1,232,000	21,823,000	5,784,000
West Virginia	50,823,000	4,134,000	562,000	7,501,000	48,018,000	−2,805,000
Wyoming	735,465,000	195,070,000	21,600,000	62,132,000	890,003,000	154,538,000
Miscellaneous [4]	3,622,000	322,000		568,000	3,376,000	−246,000
Total, United States	28,378,501,000	2,705,648,000	623,099,000	2,171,187,000	29,536,061,000	1,157,560,000

[1] Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce; for, in this report, the concern is only with actually proved reserves.

[3] Crude oil only.

[4] Includes Alabama natural gas liquids; Missouri, Tennessee, and Virginia crude; and Florida crude and natural gas liquids.

TABLE 5.—*Summary of committee's annual reports covering period 1937–50*

PROVED RESERVES AS REPORTED PRIOR TO 1946

TABLE 5.—*Summary of committee's annual reports covering period 1937–50*

PROVED RESERVES AS REPORTED PRIOR TO 1946

[Barrels of 42 United States gallons]

	New oil found during year			Production during year	Estimated proved reserves as of end of year (column 3−4)	Increase over previous year
	Through revisions of previous estimates and extensions to known fields (1)	Through discoveries of new fields and of new pools in old fields (2)	Total through new discoveries, extensions, and revisions (columns 1+2) (3)	(4)	(5)	(6)
1936					13,063,400,000	
1937	2,792,790,000	928,742,000	3,721,532,000	1,277,664,000	15,507,268,000	2,443,868,000
1938	2,243,571,000	816,493,000	3,054,064,000	1,213,186,000	17,348,146,000	1,840,878,000
1939	2,058,455,000	340,667,000	2,399,122,000	1,264,256,000	18,483,012,000	1,134,866,000
1940	1,607,012,000	286,338,000	1,893,350,000	1,351,847,000	19,024,515,060	541,503,000
1941	1,538,989,000	429,974,000	1,968,963,000	1,404,182,000	19,589,296,000	564,781,000
1942	1,618,925,000	260,051,000	1,878,976,000	1,385,479,000	20,082,793,000	493,497,000
1943	1,202,368,000	282,418,000	1,484,786,000	1,503,427,000	20,064,152,000	−18,641,000
1944	1,556,192,000	511,368,000	2,067,500,000	1,678,421,000	20,453,231,000	389,079,000
1945	1,690,315,000	419,984,000	2,110,299,000	1,736,717,000	20,826,813,000	373,582,000
Dec. 31, 1945, estimated proved reserves of crude oil only [1]					19,941,846,000	

PROVED RESERVES AS REPORTED FOR 1946 AND THEREAFTER

Crude oil only:						
1946	2,413,628,000	244,434,000	2,658,062,000	1,726,348,000	20,873,560,000	931,714,000
1947	2,019,140,000	445,430,000	2,464,570,000	1,850,445,000	21,487,685,000	614,125,000
1948	3,398,726,000	396,481,000	3,795,207,000	2,002,448,000	23,280,444,000	1,792,759,000
1949	2,297,428,000	890,417,000	3,187,845,000	1,818,800,000	24,649,489,000	1,369,045,000
1950	1,997,769,000	564,916,000	2,562,685,000	1,943,776,000	25,268,398,000	618,909,000
Natural gas liquids only:						
1946	[2]	[2]	[2]	[2]	3,163,219,000	
1947	192,237,000	59,301,000	251,538,000	160,782,000	3,253,975,000	90,756,000
1948	405,874,000	64,683,000	470,557,000	183,749,000	3,540,783,000	286,808,000
1949	294,211,000	92,565,000	386,776,000	198,547,000	3,729,012,000	188,229,000
1950	707,879,000	58,183,000	766,062,000	227,411,000	4,267,663,000	538,651,000
Total liquid hydrocarbons:					24,036,779,000	
1946	[2]	[2]	[2]	[2]	24,741,660,000	704,881,000
1947	2,211,377,000	504,731,000	2,716,108,000	2,011,227,000	26,821,227,000	2,079,567,000
1948	3,804,600,000	461,164,000	4,265,764,000	2,186,197,000	28,378,501,000	1,557,274,000
1949	2,591,639,000	982,982,000	3,574,621,000	2,017,347,000	29,536,061,000	1,157,560,000
1950	2,705,648,000	623,099,000	3,328,747,000	2,171,187,000		

[1] Up to and including its figures on proved reserves of petroleum, as of Dec. 31, 1945, the committee combined under that heading the estimated proved reserves of cycle-plant and lease condensate. As of Dec. 31, 1945, the reserves so included totaled 884,967,000 barrels and as of Dec. 31, 1944, there were 668,701,000 barrels included. Beginning with the report of Dec. 31, 1946, the figures in this table show crude oil and natural gas liquids. It is to be remembered that, previous to Dec. 31, 1946, not all classes of natural gas liquids were included. For this reason the totals for crude oil and natural gas liquids, as herewith recorded for 1946, 1947, and 1948 are not comparable with the figures recorded for years prior to 1946.

[2] This detail not available for 1946.

REPORT OF THE COMMITTEE ON NATURAL GAS RESERVES OF THE AMERICAN GAS ASSOCIATION

To the Executive Board of the American Gas Association:

Your committee on natural gas reserves herewith submits its sixth annual report, summarizing the proved recoverable reserves of natural gas and natural gas liquids of the United States, as of December 31, 1950, as follows:

Natural gas reserves

	Thousands of cubic feet
Total proved reserves as of Dec. 31, 1949	180, 381, 344, 000
Extensions and revisions of previous estimate	9, 172, 381, 000
New reserves discovered in 1950	2, 877, 351, 000
Net changes in "stored gas" during 1950	54, 301, 000
Total proved reserves added and net changes in "stored gas" during 1950	12, 104, 033, 000
Total proved reserves as of Dec. 31, 1949, and additions during 1950	192, 485, 377, 000
Deduct production during 1950	6, 892, 678, 000
Total proved reserves of natural gas as of Dec. 31, 1950	185, 592, 699, 000

Reserves data are shown by States in table 6.

Natural gas liquids reserves

	Barrels of 42 United States gallons
Total proved reserves as of Dec. 31, 1949	3, 729, 012, 000
Extensions and revisions of previous estimate	707, 879, 000
New reserves discovered in 1950	58, 183, 000
Total proved reserves added in 1950	766, 062, 000
Total proved reserves as of Dec. 31, 1949, and new proved reserves added in 1950	4, 495, 074, 000
Deduct production during 1950	227, 411, 000
Total proved reserves of natural gas liquids as of Dec. 31, 1950	4, 267, 663, 000

Reserves data are shown by States in table 7.

Table 8 is a summary of the committee's annual estimates of proved natural gas reserves for the past 6 years, reflecting the changes in the natural gas reserve position in the United States during each of the 5 years since December 31, 1945. Table 9 shows the proved natural gas liquids reserves of the United States for the last 5 years and the changes which have taken place in these reserves annually since the first estimate was made as of December 31, 1946.

In order to arrive at an estimate of the total proved liquid hydrocarbon reserves in the United States, the reserves of natural gas liquids shown in table 7 have been added to the reserves of crude oil estimated by the committee on petroleum reserves of the American Petroleum Institute. The total liquid hydrocarbon reserves are shown in table 9 of the report of the committee on petroleum reserves.

The committee has continued the practice begun in the report of December 31, 1948, of reporting the volume of gas in storage in underground reservoirs. The "stored gas" is considered to be the gas which has been transferred from its original location in a gas and/or oil field to another natural underground reservoir for the primary purposes of conservation, fuller utilization of pipeline capacities, and more effective delivery to markets. The stored gas reserve is the quantity placed in a natural reservoir and not yet removed. Any additional recoverable gas which may have been in the underground storage reservoirs when injection was begun and has not yet been produced is classified and listed in its proper category. Withdrawals from or additions to storage are included in the figures shown under the heading "Net change in underground storage." This is dis-

tinguished from "net production" which refers to gas removed from a producing reservoir.

The committee wishes to point out again that it is often not possible to estimate the total reserves of a field in the year of its discovery. Satisfactory estimates can be made only after there has been sufficient drilling in the field and, in some cases, adequate production history. For these reasons, the reserves listed as discovered during any current year must be considered only as the reserves indicated by the drilling in that year. The estimated reserves of the new fields and pools will be revised in future reports in the light of later developments and shown as "Extensions and revisions."

The procedure followed in estimating and assembling the proved reserve figures were the same as those used in past reports. Proved reserves may be in either the drilled or undrilled portion of a given field. Where the undrilled areas are considered proved, they are so related to the developed acreage and to the known field geology and structure that their productive ability is considered assured. Proved recoverable reserves of natural gas are the reserves estimated to be producible under present operating practices. Since the estimates are made by fields, the recovery factors or abandonment pressures used in the calculations were governed by the operating conditions in each individual field. Proved recoverable reserves of natural gas liquids are those contained in recoverable gas reserves.

For purposes of developing these reserve estimates, natural gas liquids are defined as those hydrocarbon liquids that are gaseous in the reservoir but are obtainable by condensation or absorption. Natural gasoline, condensate, and liquefied petroleum gases fall in this category. In order to prevent misunderstanding of this term it is further amplified as follows: The natural gas liquids are those heavier hydrocarbon components of the natural gas which may be removed and reduced to the liquid state by various processes. These processes usually take place in field separators, scrubbers, gasoline plants, or cycling plants. The liquids so collected and the products made from them in some of the modern plants are known by a variety of names, but they have been grouped together here under the general heading "Natural gas liquids."

The estimates presented in this sixth annual report incorporate the results of careful detailed studies of many hundreds of fields and pools throughout the United States. Their preparation has required the help and active cooperation of specially trained geologists and engineers familiar with the developments in many producing areas throughout the country. The committee is fortunate in the help it has received from this group of men who have served as subcommittee members. As in past years, they have given generously of their time and effort to make these estimates as complete and accurate as possible. The committee expresses its appreciation to these men.

The committee also acknowledges the helpful cooperation of the committee on petroleum reserves of the American Petroleum Institute. The estimates of dissolved gas reserves are based on that committee's estimates of crude oil reserves.

Appended is a list of the subcommittee members.

Respectfully submitted.

Committee on Natural Gas Reserves: N. C. McGowen (chairman), United Gas Corp.; R. M. Bauer, Southern California Gas Co.; E. A. Brown, Lone Star Gas Co.; R. O. Garrett, Arkansas-Louisiana Gas Co.; Charles C. Hoffman, Cities Service Gas Co.; Frederick S. Lott, Bureau of Mines, Department of the Interior; W. S. McCabe, Stanolind Oil & Gas Co.; L. H. Meltzer, Union Producing Co.; Perry Olcott, Humble Oil & Refining Co.; E. E. Roth, Columbia Engineering Corp.; J. T. Scopes, Union Producing Co.; Henry Toler, Southern Natural Gas Co.; C. E Turner, Phillips Petroleum Co.; George H. Smith, secretary, American Gas Association; O. E. Zwanzig, assistant secretary, American Gas Association.

TABLE 6.—*Estimated proved recoverable reserves of natural gas in the United States*

[Millions of cubic feet—14.65 pounds per square inch atmospheric at 60° F.]

	Reserves [1] as of Dec. 31, 1949	Changes in reserves during 1950				Reserves as of Dec. 31, 1950 [1]				
		Extensions and revisions [1]	Discoveries of new fields and new pools in old fields [1]	Net change in underground storage [2]	Net production [3]	Total (columns 7+8+9+10, also columns 1+2+3+4 less column 5)	Nonassociated [4]	Associated [5]	Dissolved [6]	Underground storage [7]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Arkansas	874,190	65,072	23,129	540	55,338	907,593	450,935	157,869	296,789	2,000
California [8]	9,991,635	225,279	71,840	4,028	532,396	9,760,386	2,702,746	2,286,788	4,751,693	19,159
Colorado	1,227,095	−134,453	41,426	0	18,595	1,115,473	474,704	33,528	607,241	0
Illinois	233,192	26,774	5,700	0	35,773	229,893	5,643	15,000	209,250	0
Indiana	25,200	6,720	4,920	750	6,400	31,190	4,000	5,000	21,440	750
Kansas	14,089,560	64,729	30,360	153	393,968	13,790,834	13,381,105	152,189	228,239	29,301
Kentucky	1,349,397	49,294	8,200	−908	75,400	1,330,583	1,254,997	0	64,000	11,586
Louisiana [8]	26,687,811	2,010,120	751,133	0	915,798	28,533,266	22,477,745	4,162,574	1,892,947	0
Michigan	214,911	−14,820	2,741	10,528	18,286	195,074	121,867	0	40,906	32,301
Mississippi	2,528,969	130,470	5,030	0	145,263	2,519,206	1,772,969	410,436	335,801	0
Montana	803,471	34,951	0	2,402	43,463	797,361	722,647	44,799	25,421	4,494
Nebraska	8,063	9,028	28,073	0	1,058	44,106	14,886	21,213	8,007	0
New Mexico	6,241,003	866,625	124,404	6,883	248,245	6,990,670	3,978,271	2,098,103	896,210	18,086
New York	66,685	200	0	1,094	3,200	64,779	53,375	0	595	10,809
Ohio	652,571	38,751	7,900	6,840	47,200	658,862	550,548	0	34,500	73,814
Oklahoma	11,625,979	486,813	121,163	8,250	607,918	11,634,287	7,509,209	1,011,782	3,088,927	24,369
Pennsylvania	621,680	31,000	50,000	−509	75,000	627,171	528,569	0	40,750	57,852
Texas [8]	99,170,403	5,055,893	1,557,691	490	3,380,400	102,404,077	71,529,387	17,646,015	13,228,185	490
Utah	65,577	8,196	15,112	0	4,133	84,752	76,331	0	8,421	0
West Virginia	1,715,233	105,152	21,750	13,540	205,000	1,650,675	1,513,009	0	81,500	56,166
Wyoming	2,173,677	96,631	2,749	220	78,288	2,194,989	1,481,156	128,456	584,864	513
Miscellaneous [9]	15,042	9,956	4,030	0	1,556	27,472	24,356	0	3,116	0
Total	180,381,344	9,172,381	2,877,351	54,301	6,892,678	185,592,699	130,628,455	28,173,752	26,448,802	341,690

[1] Excludes gas loss due to natural gas liquids recovery.
[2] The net difference between gas stored in and gas withdrawn from underground storage reservoirs.
[3] Net production equals gross withdrawals less gas injected into underground reservoirs; changes in underground storage are excluded. December production estimated occasionally.
[4] Nonassociated gas is free gas not in contact with crude oil in the reservoirs.
[5] Associated gas is free gas in contact with crude oil in the reservoirs.
[6] Dissolved gas is gas in solution with crude oil in the reservoirs.
[7] Gas held in underground reservoirs for storage purposes only.
[8] Includes offshore reserves.
[9] Includes Alabama, Florida, Maryland, Missouri, North Dakota, and Virginia.

[9] Includes Alabama, Florida, Maryland, Missouri, North Dakota, and Virginia.

TABLE 7.—*Estimated proved recoverable reserves of natural gas liquids in the United States* [1]

[Thousands of barrels of 42 United States gallons]

	Reserves as of Dec. 31, 1949	Changes in reserves during 1950			Reserves as of Dec. 31, 1950			
		Extensions and revisions	Discoveries of new fields and new pools in old fields	Net production	Total (columns 6+7+8, also columns 1+2+3 less column 4)	Nonassociated	Associated	Dissolved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Arkansas	55,642	745	230	3,679	52,938	31,997	7,586	13,355
California [2]	320,275	71,079	250	28,217	363,387	0	137,492	225,895
Colorado	24,190	−10,837	0	432	12,921	873	0	12,048
Illinois	26,666	3,003	28	3,438	26,259	28	75	26,156
Indiana	126	34	24	32	152	20	25	107
Kansas	104,405	60,578	341	3,746	163,578	159,702	1,594	2,282
Kentucky	13,245	308	154	1,780	11,927	[3] 11,927	0	0
Louisiana [2]	596,422	56,492	18,992	28,394	643,512	498,484	97,437	47,591
Michigan	1,203	−75	14	124	1,018	609	0	409
Mississippi	56,407	2,040	100	2,650	55,897	26,558	23,295	6,044
Montana	3,710	81	0	244	3,547	3,547	0	0
Nebraska	37	65	140	7	235	74	107	54
New Mexico	85,719	11,773	1,370	4,965	93,897	30,876	33,211	29,810
Ohio	1,670	108	12	102	1,688	[3] 1,688	0	0
Oklahoma	234,030	61,897	3,922	20,946	279,903	121,708	24,868	133,327
Pennsylvania	2,643	135	68	247	2,599	[3] 2,599	0	0
Texas [2]	2,143,711	443,190	31,326	122,188	2,496,039	1,434,654	359,067	702,318
Utah	208	−9	0	5	194	194	0	0
West Virginia	12,831	634	212	4,701	8,976	[3] 8,976	0	0
Wyoming	43,863	6,636	0	1,512	48,987	37,675	6,390	4,922
Miscellaneous [4]	9	2	0	2	9	0	0	9
Total	3,729,012	707,879	58,183	227,411	4,267,663	2,372,189	691,147	1,204,327

[1] Includes condensate, natural gasoline and liquefied petroleum gas.
[2] Includes off-shore reserves.
[3] Not allocated by types but occurring principally in the column shown.
[4] Includes Alabama and Florida.

TABLE 8.—*Summary of annual estimates of natural gas reserves for period Dec. 31, 1945, to Dec. 31, 1950*

[Millions of cubic feet—14.65 pounds per square inch atmospheric, at 60° F.]

Year	Natural gas added during year			Net change in storage	Net production during year	Estimated proved reserves as of end of year	Increase over previous year
	Extensions and revisions	Discoveries of new fields and new pools in old fields	Total of discoveries, revisions and extensions				
1945						147,789,367	
1946	(1)	(1)	17,729,152	(1)	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	(1)	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
1949	8,061,429	4,612,870	12,674,299	82,746	6,245,041	180,381,344	6,512,004
1950	9,172,381	2,877,351	12,049,732	54,301	6,892,678	185,592,699	5,211,355

[1] Not estimated.

TABLE 9.—*Summary of annual estimates of natural gas liquids reserves for period Dec. 31, 1946, to Dec. 31, 1950*

[Thousands of barrels of 42 United States gallons]

Year	Natural gas liquids added during year			Net production during year	Estimated proved reserves as of end of year	Increase over previous year
	Extensions and revisions	Discoveries of new fields and new pools in old fields	Total of discoveries, revisions, and extensions			
1946				129,262	3,163,219	
1947	192,237	59,301	251,538	160,782	3,253,975	90,756
1948	405,874	64,683	470,557	183,749	3,540,783	286,808
1949	294,211	92,565	386,776	198,547	3,729,012	188,229
1950	707,879	58,183	766,062	227,411	4,267,663	538,651